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THE AMERICAN CHEMICAL SOCIETY.

I.—Proceedings.

Regular Meeting, January 3d, 1881.

At 9 P.M. the Society was called to order by its President, Prof. Charles F. Chandler, who occupied the chair. Sixteen members were present.

The minutes of the last meeting were read by Mr. Arthur H. Elliott, late Recording Secretary, and adopted.

A copy of the last annual report, as filed with the County Clerk, was read by Mr. Arthur H. Elliott, also a report of the last meeting of the Board of Directors, December 13th, 1880.

The following gentlemen were nominated:

As associate member:

Mr. E. K. Dunham, School of Mines, N. Y.

Nominated by { Arthur H. Elliott, C. F. Chandler, E. Waller.

As members:

Mr. James F. Slade, 5 East Thirty-eighth street, N. Y.

Nominated by { James H. Stebbins, Jr., Arthur H. Elliott, C. F. Chandler.

Mr. Theodore M. Hopke.

Nominated by { Arthur H. Elliott, C. F. Chandler, M. Benjamin.

The following gentlemen resigned their membership:

Prof. Ira Remsen, resignation accepted unanimously.

Prof. Saddler, resignation accepted unanimously.

Mr. C. W. Drew, Burlington, Vt., resignation accepted unanimously.

Mr. Harkley, resignation accepted unanimously.

It was announced that the Board of Directors had reduced the annual dues to $5.00.

After considerable discussion their action was adopted with but one dissenting voice.

It was announced that the Board of Directors had altered the day of meeting from Thursday to Monday. After some discussion their action was unanimously adopted.

On motion the Society adjourned.

ALBERT H. GALLATIN,
Recording Secretary.

THE AMERICAN CHEMICAL SOCIETY.

II.—Proceedings.

Regular Meeting, February 11th, 1881.

At 8:30 a quorum being present, but the President and Secretary being absent, the meeting was called to order by Vice-President Leeds.

The chairman stated that in the absence of the Secretary and the minutes, the regular order of business would be suspended, but that some nominations for membership which had been favorably reported upon by the Committee on Nominations, and which had been delayed, should now be acted upon. The names being duly read were as follows:

Prof. E. N. Venable, Chapel Hill, North Carolina.

Nominated by { J. W. Mallett, C. F. Chandler, A. H. Elliott.

E. K. Dunham, School of Mines, N. Y.

Nominated by { A. H. Elliott, C. F. Chandler, E. Waller.

Dr. N. Gerber, 45 S. Washington square, N Y.

Nominated by { H. Endemann, A. Behr, J. H. Stebbins, Jr.

James F. Slade, 5 East Thirty-eighth street, N. Y.

Nominated by { Jas. H. Stebbins, Jr., A. H. Elliott, C. F. Chandler.

Theodore M. Hopke.

Nominated by { A. H. Elliott, C. F. Chandler, M. Benjamin.

On motion, the Vice-President was directed to deposit an affirmative vote for the names unless some objection was made. Such ballot was duly made, and the nominees were all declared elected to membership.

Prof. Leeds then read the papers announced for the evening:

1. "Upon the Invariable Production, not only of Ozone and Hydrogen Peroxide, but also of Ammonium Nitrate, in the Ozonation of Purified Air by Moist Phosphorus." By Dr. A. R. LEEDS.

2. "Upon the Action of Ozone, Oxygen and Nascent Oxygen upon Benzene." By Dr. A. R. LEEDS.

3. "On a New Class of Aromatic Sulphurous Acids." By Dr. A. R. LEEDS.*

These papers passed to the Committee on Publication without discussion.

Mr. STEBBINS then presented a short paper, "On a New Class of Azo Compounds, properly called 'Tetrazo Compounds.'"

Which also passed to the Committee on Publication without discussion.

Then by invitation from the Secretary, Mr. WALLACE GOULD LEVISON presented a note "On Absorption Spectra of Selenite, Mica, and other Substances Viewed by Polarized Light."

In discussing the paper, Mr. GIUR thought some of the phenomena described might be due to the interspaces of the substances from their foliated structure and general heterogeniety.

Prof. LEEDS also discussed some of the points taken in the paper. Notice was then given that Mr. BENJAMIN, at the next Conversazione, would exhibit specimens of Balmain's luminous paints.

The Society then adjourned.

E. R. SQUIBB, VICE-PRES.,
Acting Secretary.

* For the present withdrawn by the author.—ED.

III.—Upon the Invariable Production, not only of Ozone and Hydrogen Peroxide, but also of Ammonium Nitrate, in the Ozonation of Purified Air by Moist Phosphorus.

By Dr. A. R. Leeds.

As the result of very numerous quantitative experiments performed two years ago, and published in the Journal American Chemical Society, **1**, 145, and *Chemical News* for August, 1879 ("Upon ammonium nitrite, and upon the by-products obtained in the ozonation of air by moist phosphorus"), I gave the proofs of the statement contained in the heading of this article, and the determination of the amounts of the three substances formed. Forthwith, under the title "Is ozone produced during the atmospheric oxidation of phosphorus?" (*Chemical News*, **40**, 96) Mr. Kingzett, without waiting to disprove any of the above propositions by experiment, asserted that "*There is no known process of slow oxidation which has been established to produce ozone*," and that the gaseous body which I had obtained and experimented upon, was altogether peroxide of hydrogen. Mr. Kingzett insisted that the long series of wash-bottles and purifiers, which I had used to absorb and hold back as far as possible the hydrogen peroxide, did not militate at all against his assumption, for the reason that peroxide of hydrogen suspended in a vesicular condition, might pass through all the washing liquids and constitute the only active agent in the escaping gas. How greatly Mr. Kingzett's views have altered may be seen from the fact ("Report upon the atmospheric oxidation of phosphorus, etc.," *Journal Chemical Society*, December, 1880) that the points most dwelled upon by him in this last paper are, that the escaping gas contains no peroxide of hydrogen whatsoever, but consists entirely of ozone, and that "the peroxide of hydrogen formed in the process is entirely deposited in the water contained in the oxidisers; and if it cannot escape condensation in the aqueous spray and vapor of the oxidisers, it cannot be expected to escape solution in five wash-bottles."

Since the statements of Mr. Kingzett now, are diametrically opposed to those which he made when he attacked my results in the beginning, I think it will facilitate the labors of future workers in this field, if I present a brief summary of the facts hitherto established.

When I first entered upon the study of the phenomena exhibited in the aerial oxidation of moist phosphorus (October, 1878), the first difficulty encountered arose from the unsatisfactory character of the

apparatus previously employed, and the impossibility of obtaining a stream of oxidised air containing a uniform and definite percentage of ozone. These difficulties disappeared when it was ascertained that the volume of ozone produced, under given conditions, was a definite function of the temperature, and might accordingly be expressed by a curve, having its origin at 6° C., at which temperature the production was nul, and arriving at its maximum at 24°, from this point falling off again rapidly. The manipulation was rendered easy by the phosphorus ozonator, described along with the volume-temperature experiments (JOURNAL AMERICAN CHEMICAL SOCIETY, **1**, 8, and *Chem. News*, **40**, 157). These results were referred to by Mr. Kingzett in the *Chemical News* for August, 1879, and yet in his earlier experiments performed long subsequently (February, 1880), he states that he obtained no satisfactory evidence of the production of ozone, and but little evidence of the production of peroxide of hydrogen. Later on, when working in summer weather, Mr. Kingzett obtained better results, and discovered that his previous failures had been due to his having conducted the experiments at too low temperatures.

In plotting the volume-temperature curve, the water in the jars of the ozonator was replaced by a solution of potassium bichromate and sulphuric acid of such strength, that the surface of the phosphorus was kept clean without undergoing the danger of ignition from too concentrated acid and too rapid oxidation. Mr. Kingzett states that "such a method of experiment obviously precluded examination for peroxide of hydrogen in this solution, in which the phosphorus was partially submerged," and explained why he found the relation of peroxide of hydrogen to ozone at 1 : 400.

The comment of Mr. Kingzett would have been only too just if I had looked, or proposed to look, in an acidified potassium bichromate bath for undecomposed hydrogen peroxide. But Mr. Kingzett, who criticised both papers at length (*loc. cit.*), must have known at that time, a year and a half ago, though apparently he has since forgotten, that I did not employ such a method. The potassium bichromate bath was employed in the determination of the volume-temperature curve of the evolved ozone only, and in that investigation no attempt was made to determine the hydrogen peroxide formed. That question was taken up at great length in the subsequent paper upon "Ammonium nitrite, and the by-products obtained in the ozonation of air by moist phosphorus." In the experiments therein detailed, and in which the determination of the hydrogen peroxide in the ozonising chambers and in the various wash-waters is express-

ly considered, not merely water, but water especially purified for the purpose, was employed. This and many other precautions were essential at that time, when the exact nature and extent of the sources of error were unknown. And since these sources of error are not even alluded to, nor suitable precautions to obviate them taken by Mr. Kingzett in his paper, it will be necessary to emphasize them here.

At that time, and even now, the generation of ammonium nitrite by evaporation of water was, and is taught, as an established fact. If this were indeed the case, the ozonising chambers present the most favorable conditions for its generation, and the nitrite thus formed would give the same reaction as hydrogen peroxide or ozone, when we came to titrate the water in the ozonisers with an acidified solution of potassium iodide. The elaborate experiments of Bohlig, Zabelin and Carius, however, have shown that this is not true, and that the alleged formation of ammonium nitrite by evaporation of water in air, never takes place when adequate precautions are taken to exclude from the evaporated water, the ammoniacal compounds pre-existent in the atmosphere. Fortunately, therefore, this source of error was not inherent in the experiments themselves, and it only remained to guard against it by very complete washing of the air drawn through the ozonator.

Again, Goppelsröder and Carius had shown that when ammonia is brought into contact with ozone, it is decomposed with the formation of ammonium nitrite and nitrate, and peroxide of hydrogen. It was essential, therefore, that the phosphorus should be in contact with water from which every trace of ammonia had been expelled. If this were not done, the origin of any ammonium compounds or hydrogen peroxide, found among the products of the reaction, would be rendered doubtful. It was for this reason that all the water employed in my experiments, in which a determination of the hydrogen peroxide was attempted, was *aqua purissima*, that is, water redistilled until it did not give the slightest reaction for ammonia when treated with Nessler's reagent.

Moreover, while the oxidation of water to hydrogen peroxide by *free* ozone had been abundantly disproved, yet there appeared to be much reason for supposing that during the aerial oxidation of moist phosphorus, a formation of hydrogen peroxide actually took place. If this were true, its origin could not be ascribed to a secondary action due to the ozone first formed, but to the same series of changes as those which led up to the oxidation of the oxygen mole-

cule itself. The only sufficient assignable cause was the formation of nascent oxygen, or oxygen in the atomic condition, such as it must necessarily enter into during some moment of the chemical change, when a substance of uneven quantivalence, like phosphorus, undergoes oxidation. That oxygen in an uncombined or monatomic condition, might peroxidise the water molecule, while oxygen already combined in a triatomic molecule might not, appeared to be a legitimate hypothesis. That nascent oxygen might oxidise the nitrogen molecule at the same time, and generate, in the presence of water, ammonium nitrate, I regarded likewise as a not improbable supposition. For this reason, excessive care was taken to preclude the presence of atmospheric ammoniacal or nitrous compounds, both in the air drawn through the ozonator, and also in the water brought into contact with the phosphorus in the ozonator jars.

The mental picture which was formed at that time of the sequence of phenomena to be studied, was embodied in the following equations, the last three being imagined as contemporaneous:

(1.) $P_4 + O_{14} = P_2O_5 + P_2O_3 + 2O_2 + O + O.$

(2.) $O_2 + O = O_3.$

(3.) $HOH + O = HOOH.$

(4.) $NN + 2H_2O + O = NH_4NO_3.$

The experiments performed now two years ago, and the repetition of which, though in an imperfect manner and with the neglect of essential precautions, constitute the substance of Mr. Kingzett's report to the Chemical Society above alluded to, were framed with a view of testing the truth or falsity of the above propositions. What these experiments actually were, may be seen by inspection of the accompanying scheme of them, which, with one exception, was followed to the letter:

I. Use of a measured amount of aqua purissima in the ozonator jars.

II. Complete straining and washing of the air by means of cotton wool, aqua purissima, caustic soda and sulphuric acid, both of the latter previously tested and shown to be free from nitrogen compounds.

III. Height of the phosphorus cakes before and after the experiments.

IV. Amount of ammonia in the jar-water at the close of the experiment.

V. Amount of the nitrites and nitrates, as determined by reduction.

VI. Amount of nitrous acid, as determined by metadiamidobenzole.

VII. Amounts of phosphoric and phosphorous acids, and of *hydrogen peroxide in the jar-water* (ozonising chambers).

VIII. Estimation of ammonia, nitrates and nitrites, nitrous acid alone, phosphoric acid, phosphorous acid and hydrogen peroxide, in the water used to wash the escaping products of ozonation.

IX. Similar estimations, except of the phosphorus compounds, in the solutions used to wash the entering air.

X. Measurement of total volumes of air used, and of ozone after its escape from the water employed in washing.

With regard to the first two heads of this scheme, it is to be noted that the *proof* of the exclusion of all compounds of nitrogen from the substance entering into the reaction, was essential to establishing this vital fact—that any nitrogen compounds found among the *products* were the results of chemical changes induced in the process of ozonation itself. That this preliminary proof was of the highest importance was shown by the results of the investigation; it was found that while no ammonium nitrite was present in the water of the ozonising chambers or in the wash-water, of ammonium nitrate a considerable amount (27.39 mgrms) was present in the first, and a determinable quantity (0.31 mgrm) even in the latter. Until adequate experimental evidence, therefore, is adduced to the contrary, the formation of ammonium nitrate during the ozonation of purified air by moist phosphorus, is to be regarded as a fact which cannot be overlooked, and one which demands an explanation in any theoretic account of the chemical phenomena involved.

Mr. Kingzett, however, does not even contemplate the possibility of the nitrogen, which is relatively the most abundant of the substances present, taking part in the reaction. To say nothing of the fact that his arrangements for washing the air were inadequate, there is no proof given that the water used by him in contact with the phosphorus was pure. If it was ordinary distilled water, it certainly was not pure, but contained the very body (ammonia) which was the worst possible impurity, so far as the question at issue was concerned. Not to speak of the discovery of Goppelsröder and Carius, that ammonia is converted by ozone into hydrogen peroxide and the nitrate and nitrite of ammonia. No experiment is narrated by Mr. Kingzett in which he sought to determine whether nitrous acid was present or not, in any of the liquids examined. In the entire absence

of such tests, his determinations of the amounts of hydrogen peroxide, etc., are correspondingly incomplete. That this is not hypocriticism, is shown by the fact that the dense white fumes which are seen in the ozonising chambers, at one time were attributed by Schönbein to ammonium nitrite.

By referring to the seventh head of the scheme, it will be seen that the determination of hydrogen peroxide in the ozonising chambers was expressly mentioned, and as preliminary to this determination, experiments were made upon the possible influence of phosphorous acid upon the titration for the peroxide, and elaborate pains were taken to prove the absence of nitrous acid in the water examined. My surprise was very great on finding, after the publication of the paper, that while the hydrogen peroxide in the wash-water, and every other point in the scheme had been determined, this particular estimation had been overlooked. For this reason, in every communication written subsequently, I have never committed myself to any statement as to the total amount of hydrogen peroxide produced, knowing that it was the sum of three quantities:

1st. That referred to under the seventh head, which remains behind in the jar-water.

2d. That carried forward in a state of aerial suspension, and partly detained by the wash-water.

3d. That escaping along with the ozone in the evolved gas.

Mr. Kingzett has called my attention to the oversight in carrying out this important part of the general scheme, and has made some estimations of the amounts of hydrogen peroxide in the ozonising chambers. Unfortunately, from his use of an acidified solution of potassium iodide as a reagent for titrating the evolved gas, and from his having employed a fan to blow the air through the apparatus without indicating the method of measuring the air, I am unable to use his results.

In my own experiment, in which 56 liters of purified air were drawn through the ozonator, the jars containing pure water, the amount of ozone in the evolved gas was 44.47 mgrms; that of hydrogen peroxide in the jar-water, 35.69 mgrms. This would give for the ratio of the ozone to the hydrogen peroxide, in this particular experiment, 1 : 0.8, or by molecules ($O_3 = H_2O_2$), as 1 : 0.8.

In my earlier paper (August, 1879), the amount of ozone in the evolved gas bore to the amount of peroxide of hydrogen, the ratio of 400 : 1. In these experiments, it was supposed that a long series of wash-bottles was sufficient to wash out the aerially suspended hydro-

gen peroxide, and hence the number, 400 : 1, was taken as expressing the relation between the total quantities in the gas, after its escape from the ozonising chambers. No statement was made, either then or subsequently, as to the total amount of hydrogen produced (owing to my original oversight in failing to determine it in the water of the ozonising chambers), but only to the amount in the evolved gas.

Subsequently, after much more elaborate experiments (*Chem. News*, **42**, 19), this assumption was found to be false, and that after passing not only through the wash-bottles, but a length of sulphuric acid dryers, so great that every trace of moisture was removed, the ratio of the ozone to the hydric peroxide in the *evolved gas*, was far less than 400 : 1. In the last and best agreeing series of trials, it was as 51 : 31, or 1 : 0.67. The ratio of the ozone to the water formed by the decomposition of the hydrogen peroxide with the aid of heat (at 200°) was 51 : 18, or approximately 3 : 1. This ratio was accidentally given instead of the former, in stating the result of the trials (*loc. cit.*)

But it will be asked, what proof is there that the neutral solution employed in titrating the current of ozone and hydrogen peroxide, would indicate the ozone only and not the peroxide as well? The answer is to be found in the fact that hydrogen peroxide held in vesicular suspension will pass through neutral potassium iodide solution without causing any appreciable decomposition in the latter. This was verified in the following experiment.* "Perfectly pure and dry oxygen was ozonised by one of the 'ozonising elements' (electrical ozonisers), and then drawn through three bulbs, the first containing a solution of neutral potassium iodide, the second water, and the third chromic acid. The latter was connected with an aspirator. As soon as the strongly ozonised oxygen came into contact with the potassium iodide, a very slow current being employed, a yellow coloration made its appearance on the surface of the solution in the first bulb, and above the surface the characteristic white cloud. On increasing the rapidity of the current, this white cloud was drawn through the water and chromic acid into the aspirator, and remained for one or more hours before its absorption was complete. After drawing over six liters of oxygen containing 0.194 grm of ozone, the water was titrated, and found to have absorbed 0.31 mgrm of peroxide of hydrogen. The chromic acid solution was unaffected, showing that the suspended hydrogen peroxide may pass

* JOURNAL AMERICAN CHEMICAL SOCIETY, **2**, 157.

through it without effecting a decomposition. The same remark applies to a neutral potassium iodide solution put in the place of the chromic acid. The excessively dilute hydrogen peroxide held in a state of aerial suspension, was not able to decompose the neutral iodide during the course of the experiment. Of course, an *acidified* solution could not be employed to absorb the peroxide, since, as above shown, its decomposition occurs under the action of oxygen alone."

The conclusion, therefore, to be drawn from the above result is, that in the ozonation of air by moist phosphorus, the number of molecules of hydrogen peroxide approximates very nearly to an equality with the number which is, *pari passu*, formed of molecules of ozone. That it does not fully equal the number, may possibly be connected with the production, as the third essential result of the action of nascent oxygen under the circumstances studied, of a certain amount of ammonium nitrate. And not only does this relation exist between the amounts of ozone and hydrogen peroxide *produced*, but subsists with little alteration, after the two bodies have been passed through many wash-bottles and have been, for a considerable interval, in contact with one another in the *evolved gas*.

Now that I have reviewed my own labors in this direction, I wish briefly to examine Mr. Kingzett's statements concerning them.

After incorrectly stating that I looked for hydrogen peroxide in an acidified potassium bichromate bath, Mr. Kingzett adds: "Moreover, it is not apparent from his various communications that he subjected his gaseous product to any very special examination. He seems to have relied upon its odor and general characters rather than upon any exclusive properties, as evidence of its nature."

In the first place, with regard to the odor, Mr. Kingzett has apparently overlooked the fact that, unlike his present position, which is that the body evolved is all ozone, and contains no hydrogen peroxide, he maintained at that time the opposite—that the gas evolved was altogether hydrogen peroxide, and contained no ozone. And the only connection in which I have brought forward the smell of ozone, as an important physical quality, was to state that attention to it might have prevented Mr. Kingzett from so positively affirming that a gas which possessed the powerful and unique smell of ozone, was not ozone, but another body, viz: hydrogen peroxide, which is entirely odorless.

In the next place, Mr. Kingzett has brought forward only two tests, which differ from those which I have applied. The first con-

sisted in passing the ozonised air through turpentine, and assuming that the failure of the gas, after its passage, to set free iodine in a potassium iodide solution, demonstrated that it originally contained ozone only. But until it has been shown that hydrogen peroxide suspended in the gaseous current, would not undergo absorption by oil of turpentine as well, the proof is valueless.

That this absorption would probably take place may be inferred from the action of organic liquids in general, for when the current of ozonised gas is passed into alcohol, ether or glycerine (JOURNAL AMERICAN CHEMICAL SOCIETY, **1**, 448), the white cloud entirely disappears, and hydrogen peroxide is found in the liquid. In this respect the organic liquids strikingly differ from solutions of potassium iodide, water, acidified chromates, etc., inasmuch as the latter do not arrest the suspended hydrogen peroxide.

Mr. Kingzett's second novel test consisted in heating the ozonised air to 240°, and assuming that the entire destruction of the active agent at this temperature proved that it was ozone. The information to be derived from heating the gas under proper conditions, is perhaps the most conclusive of any that can be obtained, as to its true nature. But, as Mr. Kingzett has applied the test, he has deprived it of the very conditions essential to its value. For at 240°, not only ozone, but also peroxide of hydrogen is destroyed, and there is nothing in the test as he has applied it, to prove that the active agent was ozone only, or peroxide of hydrogen only, or a mixture of both.

Prior to this, I had made use of the same test (JOURNAL AMERICAN CHEMICAL SOCIETY, **2**, 147, and *Chem. News*, **42**, 19), but in a different manner. The ozonised air, after extended washing, was completely dessicated, and then exposed to temperatures running from the ordinary up to 200°. It was shown that as the reaction for ozone diminished with the successive increments of temperature, the quantities of water derived from the decomposition of the suspended hydrogen peroxide, as regularly increased. The numbers obtained by experiment exhibited this diminution of ozone and increment of water, as uniformly as was to be reasonably anticipated in view of the difficult nature of the work. The total amount of water obtained in twelve experiments was 0.0086 grm, corresponding to 0.016 grm hydrogen peroxide; the total amount of water obtained in blank experiments continued for a much longer time than those reported, and differing from the latter only in the circumstance that the phosphorus cakes were kept submerged beneath the surface of the water in the ozona-

tor jars, was zero. We have seen with what neglect of essential precautions Mr. Kingzett has applied this test. Against my results he has to urge merely his conviction (?) that they were wrong, and that the amounts of water weighed were due to water only, and not to H_2O_2. It is hardly worth while to comment—0.016 grm is a ponderable quantity, the reality of which is capable of experimental proof or disproof, whilst a conviction is not necessarily of any weight except in the mind of its author.

The only experiment which Mr. Kingzett has brought forward in this connection, shows that he has failed to apprehend the real question at issue. He passed a rapid current of air through a solution of hydric peroxide, and inferred that the failure of the air, after its passage, to effect a noteworthy decomposition in an acidified potassium iodide solution, proved (what it did not) that no H_2O_2 could be carried forward when the H_2O_2 was in a *state of aerial suspension.* Mr. Kingzett's experiment is a repetition of a similar one of my own published previously (JOURNAL AMERICAN CHEMICAL SOCIETY, **2**, 154), but illustrates merely the well-known fact that hydrogen peroxide is a difficultly vaporisable body. Mr. Kingzett appears to think that the use of a *rapid* stream of air had some bearing upon the question, and speaks of a spray of peroxide of hydrogen. The phenomena which are under investigation cannot be studied in this manner. The state of vesicular suspension of the hydrogen peroxide is not one which, so far as we are at present aware, can be brought about by mechanical means, but is one which hydrogen peroxide assumes only when it is the immediate result of a previous chemical change. This is its condition when formed in the phosphorus ozonator, and likewise when ozone undergoes decomposition in presence of water, as when it is absorbed by a solution of potassium iodide, and is the origin of the white cloud seen under these circumstances over the surface of the latter. The difference between the two conceptions Mr. Kingzett would have noted, had he been acquainted with what is the most striking reaction which occurs during the ozonation of air by moist phosphorus. This is the permanent white cloud which fills the ozonator, and is carried forward through an extensive series of wash-bottles, and remains sometimes for hours without undergoing absorption, above the surface of the water in an aspirator employed to draw air through the apparatus. This white cloud was the antozone of Schönbein, which he, and after him, Meissner, labored unsuccessfully for so many years to account for. For our knowledge of its true nature we are indebted mainly to Von Babo, and after him to Nasse

and Engler, who demonstrated that the so-called antozone is merely hydrogen peroxide, in a state of vesicular suspension. The stumbling-block which rendered of so little value the life-long labors of Meissner upon this question was, that starting out from the well-established fact that hydrogen peroxide is not volatile, he concluded that the clouds could not be due to this substance. As the only alternative, he and Schönbein ascribed them to a peculiar modification of oxygen, other than ozone. There is danger of our giving up ground acquired with great difficulty, and falling back into hopeless contradictions, if we do not keep clearly in mind the distinction between hydrogen peroxide in its ordinary condition, in which it is not volatile, and hydrogen peroxide as suspended at the moment of its formation, in a current of air or aqueous vapor. An atmosphere saturated with aqueous vapor is most favorable to the existence of the hydrogen peroxide in a state of vesicular suspension, but is not essential, since after complete withdrawal of the water vapor, the suspended hydrogen peroxide will still be present.

SUMMARY.

1st. Both ozone and hydrogen peroxide are produced during the ozonation of purified air by moist phosphorus, in the ratio approximately of one molecule of the latter to one of the former.

2d. Both bodies are evolved, the suspended hydrogen peroxide passing through a series of wash-bottles, without undergoing any but a slight absorption, and being present in the evolved gas in nearly the same ratio as that which it held to the ozone, when originally produced.

3d. Along with these two bodies, and as a necessary part of the same series of reactions, incident originally to the setting free of nascent oxygen, a certain amount of nitrate of ammonia is invariably produced. This last is altogether detained in the water of the ozonator and of the wash-bottles.

IV.—Upon the Action of Oxygen, Ozone and Nascent Oxygen upon Benzene.

By Albert R. Leeds.

I.—OXYGEN.

The first set of experiments was instituted to determine whether oxygen alone, in sun-light or diffused light, or oxygen together with platinum black, in sun-light or diffused light, would oxidise benzene after long-continued exposure. In every case a negative result was obtained, except in that of oxygen and platinum black brought into contact with benzene and a little water in a liter flask, and exposed to the direct sun-light. In the course of a few hours the liquid became slightly yellow, and at the end of eight days was dark yellow and intensely acid. A large amount of oxalic acid had been formed, but no acetic acid and no phenole.

II.—OZONE.

The earliest experiments upon the action of ozone upon benzene were made two years ago with the object of further studying the remarkable products obtained by Houzeau and Renard in the course of their investigation upon this subject.* Along with small amounts of formic and acetic acids, they obtained a gelatinous body which, when dried in vacuo, formed a white amorphous solid, and which they called ozobenzene. It was permanent only at low temperatures, and on gentle warming exploded with tremendous violence. Fearing the possible formation of this dangerous substance, the first experiment was made upon 1 grm of benzene, but the amount operated upon was gradually increased, until in the eighth and final trial, it amounted to 35 grms. In some experiments, the benzene was cooled by a freezing mixture; in other trials, it was ozonised at common temperatures, and in the last, the temperature was kept at 50°. The benzene was exposed to the oxygen, strongly ozonised by the silent discharge and containing about 70 mgrms of ozone in the liter, either in shallow dishes placed under a receiver through which the perfectly dry ozonised gas was kept flowing, or in Geissler bulbs connected with other bulbs to arrest the volatile products of ozonation. But in every case the results were the same. Large volumes of carbonic acid were given off, and the benzene, as it diminished in vol-

* *Compt. Rend.*, **76**, 572.

ume, became converted into a dark yellow, oily mass, containing crystals of oxalic acid. In other cases, when the ozonation was performed in bulbs, an amorphous blackish mass separated out on the sides of the vessels. From these residues no crystalline bodies could be obtained either by the use of solvents or by sublimation. No indications whatsoever were noted of the white explosive body spoken of by Houzeau and Renard.

Besides carbonic and oxalic, formic and acetic acids were obtained, the latter in considerable quantity. Especial care was paid to the detection of phenole, but as far as our tests were concerned, no evidence of the presence even of a trace of this body was obtained. Hydrogen peroxide was likewise absent.

III.—NASCENT OXYGEN.

The fact that triatomic oxygen (O_3, ozone or active oxygen) is not capable of oxidising water to the form of peroxide of hydrogen, while monatomic oxygen (O, or nascent oxygen) is, rendered it probable that a similar difference would be observed in the effects of ozone and of nascent oxygen, upon benzene. This supposition has been confirmed by experiment. The nascent oxygen was obtained by the action of phosphorus, partially submerged beneath the surface of water, upon air at common temperatures. When no benzene is present, the nascent oxygen oxidises the oxygen molecule to the form of ozone, the water molecule to hydrogen peroxide, and the nitrogen molecule in the presence of water, to ammonium nitrate. But on the addition of benzene, the ozone reaction disappears. The resulting products differ, according as the reaction takes place in sun-light or in diffused light. In the former case, after prolonged exposure, large amounts both of phenole and oxalic acid are formed, the phosphorus is converted into yellowish-red amorphous phosphorus, and the liquid remains colorless. In the latter case, the flask being kept in a warm place, the liquid becomes of a dark-brown color, and abundance of oxalic acid, but no phenole, is formed. At common temperatures the phosphorus goes into solution in the benzene, and is gradually converted into a mass of white dodecahedral crystals, the liquid remaining colorless. It is only when the temperature is above the melting point of the phosphorus (in these trials, 50–70°) that the dark brown liquid is produced. Curiously enough, though the flask becomes filled with dense white fumes, no inflammation took place at these elevated temperatures, the benzene vapor apparently protecting the phosphorus from ignition. Excess of calcium chloride was added to

the sirupy liquid, the dense precipitate of calcium phosphate and oxalate (somewhat dark from a portion of the organic matter carried down at the same time) filtered off, and the filtrate evaporated to dryness. The soluble portions were then dissolved out with the least possible amount of water, the excess of calcium precipitated out by potassium sulphate, the whole evaporated to dryness, and treated with absolute alcohol. As a small portion of the potassium chloride was taken up by the alcohol, this extract was again evaporated to dryness, and the operation repeated three times, when only the organic matter remained in solution. It was of a yellow color and pasty consistence, but as it could not be made to crystallize, and furthermore was in small amount, its further investigation was abandoned.

After my own research was in progress, I found that Prof. F. Hoppe-Seyler,* starting out from similar views as to the effects resulting from the action of nascent hydrogen upon oxygen, had performed a series of interesting experiments with hydrogenised palladium foil. A piece of such foil shaken up along with benzene, water and air, in a flask, and allowed to stand for a time, yielded an amount of phenole sufficient, after its conversion by the addition of bromine water into tribromphenole, for analysis. Besides the phenole, Hoppe-Seyler obtained a body which turned brown on the addition of potash.

On repeating the experiment, I obtained a very abundant reaction for phenole. On addition of lime-water, the coloring matter which had been formed at the same time, was thrown down as a yellowish-brown precipitate. Not a trace of oxalic acid was present.

To my own mind, no satisfactory explanation could be given of the formation of phenole under these circumstances, except upon the supposition of the production of peroxide of hydrogen as an intermediate step. In the case of phosphorus oxidising in moist air, the contemporaneous formation of both ozone and peroxide of hydrogen, by the action of the nascent oxygen upon the oxygen and water, is a demonstrated fact.

Three suppositions therefore were admissable. Either the phenole was formed by the direct action of the nascent oxygen ; or 2d. By the action of the ozone, or 3d. By the action of peroxide of hydrogen. The first supposition requires that the oxygen should produce by direct synthesis a molecule of phenole, which is in the highest degree improbable. The second supposition is inadmissable, since

* *Ber. der deutsch. Chem. Gesell.*, **12**, 1551.

the non-formation of the phenole by treatment with ozone had been abundantly proven. The third supposition admitted of the rational explanation expressed by the formula,

$$C_6H_6 + HO\text{–}OH = C_6H_5OH + H_2O.$$

Two modes of testing the validity of the third hypothesis presented themselves. The first was that of bringing the hydrogenised palladium foil into contact with water and air in a flask, and ascertaining if the oxygen rendered nascent by oxidation of the hydrogen, would oxidise the water to the form of hydrogen peroxide. In case an affirmative result was obtained in this experiment, it would be important to try the second test of treating benzene directly with a peroxide of hydrogen solution.

A strip of palladium, after remaining for several hours as the negative pole of a battery of six Bunsen elements, in water acidulated with sulphuric acid, was placed along with 10 c.c. of ammonia-free water in a half-liter flask filled with air. At the end of three days the water was tested with guaiacum and solution of diastase. It developed a deep blue color. On addition of cadmium-iodide-starch solution, iodide of starch was formed, and on titration with sodium hyposulphite, it was found that the total quantity of hydrogen peroxide present in the 10 c.c. of water amounted to 0.67 mgrm.

It is not improbable that both ozone and ammonium nitrate are likewise formed in the course of this reaction, but of the former no satisfactory indication was obtained, and the latter was not looked for, inasmuch as it would have required the repetition of the experiment on a much larger scale and with many additional precautions.

The successful issue of this experiment encouraged us to try what otherwise would not have been attempted, the treatment of the benzene with H_2O_2. 20 c.c. of benzene were allowed to stand at common temperatures for two days in contact with 300 c.c. of a slightly acidulated 1.2 per cent. solution of hydrogen peroxide. The liquids remaining colorless, the flask was attached to a reflux condenser and placed in a water-bath. After the water in the bath had been kept boiling for several days, it was saturated with chloride of calcium, and the digestion continued at this temperature for two days longer. At the end of this time the liquid had become yellow, and was found to contain beside the coloring matter, oxalic acid and phenole. A very abundant precipitate was thrown down from the aqueous solution on addition of bromine water, and this precipitate of tribromphenole, after recrystallisation from alcohol, was found to weigh 0.25 grm.

In conclusion, not only is the direct conversion of benzene into phenole by the action of hydrogen peroxide, of much interest, phenole having hitherto been obtained only by some indirect process, but it supplies a satisfactory demonstration of the validity of the third hypothesis above stated.

V.—New Azo Colors Belonging to the so-called Tetrazo Group.

By James H. Stebbins, Jr.

In order to give a clear understanding of this wonderful class of dyes, we will have to go back a few steps and consider the ordinary diazo compounds, their formation, and the azo dyes derived from them.

It is a pretty generally known fact, that when any of the salts of aniline (as the chloride, nitrate, etc.) or its homologues are treated with nitrous acid (either free or in the shape of a nitrite), that diazobenzole chlorides, etc., are formed, viz :

$$C_6H_5NH_2 + 2HCl + KNO_2 = C_6H_5 - N = N - Cl + KCl + 2H_2O.$$

Now from Griess we learn that diazo compounds unite directly with phenoles and amines to form coloring matters which belong to the class of the so-called azo compounds.

As an example of the combination of diazo compounds with phenoles, we may take the action of diazobenzole chloride upon beta naphthole, viz :

$$C_6H_5 - N = N - Cl + \beta C_{10}H_7OH$$
$$\text{form } C_6H_5 - N = N - \beta C_{10}H_6OH + HCl.$$

If, on the other hand, we allow diazobenzole to react upon an amine (as aniline), we would get an amido-azo compound,

$$C_6H_5N_2Cl + C_6H_5NH_2 = C_6H_5 - N = N - C_6H_4NH_2Cl$$

and this is the basis of the new class of colors.

Amido-azobenzole is a yellow basic coloring matter, uniting with one molecule of acids to form salts which, however, are readily decomposed with boiling water.

Now, as we have seen how nitrous acid acted upon amines, it seemed only too probable that if amido-azobenzole chloride were treated with nitrous acid, that a diazo compound would be formed, inasmuch as it contains a free amido radical (NH_2). This hypothesis was fully verified by Kékulé, who describes such a compound in his organic chemistry. This discovery, at that time, presented no value,

as azo compounds derived therefrom were insoluble in water, and could not be used for technical purposes.

Things remained in this state till a few years since, when it was discovered, that by introducing the sulpho group (HSO_3) into these compounds, they were rendered soluble in water and might be used for dyeing.

Based upon this theory, Graepler took out a patent for converting the hitherto useless amido-azobenzole into its sulpho acid, and since then the manufacture of the tetrazo dyes has made great progress.

One of the first parties to avail themselves of this invention was the firm of Calle & Co., in Biebrich, who shortly after sent into commerce a dye-stuff called "Biebrich scarlet," and this dye is produced by diazotising amido-azobenzolesulpho acids, and combining the so obtained diazobenzolesulpho acids with beta-naphthole, in an alkaline solution.

I say sulpho acids, because, in the preparation of amido-azobenzolesulpho acid, not only the mono, but also the disulpho acid are formed, and we therefore have a mixture of two dye-stuffs as the final result, viz:

I.

$$C_6H_4(HSO_3) - N = N - C_6H_4N_2 \quad + \quad \beta C_{10}H_7OH$$
$$\text{form } C_6H_4(HSO_3) - N_2 - C_6H_4 - N_2 - \beta C_{10}H_6OH.$$

II.

$$C_6H_3(HSO_3)_2 - N = N - C_6H_4N_2 \quad + \quad \beta C_{10}H_7OH$$
$$\text{form } C_6H_3(HSO_3)_2 - N_2 - C_6H_4 - N_2 - \beta C_{10}H_6OH.$$

We therefore see, that wherever an aromatic azo compound contains a free amido group, that such a compound is capable of being diazotised, and again combined with phenoles to form new coloring matters.

Basing my experiments on this theory, I have been able to produce a series of new colors, of which the following are examples:

I.

When diazo-azobenzolesulpho acid is allowed to react on an alkaline solution of phenolesulpho acid, a strong yellow dye-stuff is the result.

$$C_6H_4(HSO_3) - N = N - C_6H_4 - N_2 \quad + \quad C_6H_4(HSO_3)OH$$
$$\text{form } C_6H_4(HSO_3) - N_2 - C_6H_4N_2 - C_6H_3(HSO_3)OH.$$

This color is very soluble in water, and dyes wool of an intense yellow color in an acid bath.

II.

If diazo-azobenzolesulpho acid is allowed to react on cresole or its sulpho acid, a yellow coloring matter is likewise formed, which does not materially differ from the previous compound.

$$C_6H_4(HSO_3) - N = N - C_6H_4N_2 \quad + \quad C_6H_4(CH_3)OH$$

form $C_6H_4(HSO_3) - N = N - C_6H_4 - N = N - C_6H_3(CH_3)OH$.

III.

An alkaline solution of orcine produced an orange color.

$$C_6H_4(HSO_3) - N = N - C_6H_4N_2 \quad + \quad C_6H_3(CH_3)\begin{matrix}OH\\OH\end{matrix}$$

form $C_6H_4(HSO_3) - N = N - C_6H_4 - N = N - C_6H_2(CH_3)\begin{matrix}OH\\OH\end{matrix}$

IV.

Resorcine treated in the same way produced likewise an orange dye-stuff.

$$C_6H_4(HSO_3) - N = N - C_6H_4 - N_2 \quad + \quad C_6H_4\begin{matrix}OH\\OH\end{matrix}$$

form $C_6H_4(HSO_3) - N = N - C_6H_4 - N = N - C_6H_3\begin{matrix}OH\\OH\end{matrix}$

V.

Salicylic acid brought in contact with diazo-azobenzolesulpho acid produced a yellow dye-stuff.

$$C_6H_4(HSO_3) - N = N - C_6H_4N_2 \quad + \quad C_6H_4\begin{matrix}OH\\COOH\end{matrix}$$

form $C_6H_4(HSO_3) - N = N - C_6H_4 - N = N - C_6H_3\begin{matrix}OH\\COOH\end{matrix}$

VI.

In the same way a fine scarlet color is obtained, if beta-naphtholesulpho acid is substituted for salicylic acid.

$$C_6H_4(HSO_3) - N = N - C_6H_4N_2 \quad + \quad \beta C_{10}H_6(HSO_3)OH$$

form $C_6H_4(HSO_3) - N = N - C_6H_4 - N = N - \beta C_{10}H_5(HSO_3)OH$.

VII.

If we substitute beta-naphtholedisulpho acid for the monosulpho acid, a fine red color is the result. (Pat. by Koehler.)

$$C_6H_4(HSO_3) - N = N - C_6H_4N_2 \quad + \quad \beta C_{10}H_5(HSO_3)_2OH$$

form $C_6H_4(HSO_3) - N = N - C_6H_4 - N = N - \beta C_{10}H_4(HSO_3)_2OH$.

VIII.

Finally, if we treat azosulphoxylbenzolediazotoluole with an alkaline solution of beta-naphthole, an intense red coloring matter is

obtained. This coloring matter is very similar to Biebrich scarlet, but has a somewhat bluer shade.

$$C_6H_4(HSO_3) - N = N - C_6H_3(CH_3)N_2 \quad + \quad \beta C_{10}H_7OH$$

form $C_6H_4(HSO_3) - N = N - C_6H_3(CH_3) - N = N - \beta C_{10}H_6OH$.

These dyes are nearly twice as strong as the ordinary azo dyes, and they may be distinguished from one another by a very sharp reaction. When such a dye-stuff contains the sulpho group (HSO_3) in the benzole nucleus, it is converted into an intense green color by the addition of a few drops of strong H_2SO_4. When the sulpho groups are in both the benzole and naphthole nuclei, an intense blue color is obtained, but, when only in the naphthole nucleus, a purple color is the result.

We can thus tell almost at a glance, the nature of the color under examination.

THE AMERICAN CHEMICAL SOCIETY.

VI.—Proceedings.

Regular Meeting, March 7th, 1881.

At 8:30 P.M. the Society was called to order by Vice-President Dr. E. R. Squibb, who presided.

Sixteen persons were present at the time.

The minutes of the January meeting were read by the Recording Secretary. Adopted.

The minutes of the February meeting were read by the Recording Secretary. Adopted.

The following gentlemen resigned their membership:

Mr. Elihu Root, Mr. H. J. Schmitz,
Dr. T. J. O'Connor, Mr. Florian Alexander.

Their resignations were adopted unanimously.

Mr. Casamajor announced that Dr. Gallatin had resigned his office as Recording Secretary. The resignation was accepted with regret.

It was moved that a committee of one be appointed by the chair to select a new Recording Secretary. Carried unanimously. Mr. Casamajor was appointed as said committee.

The following gentlemen were nominated as new members:

J. G. Mattison.

Nominated by { P. de P. Ricketts, Arthur H. Elliott, C. F. Chandler.

Theo. Tonnelé.

Nominated by { P. de P. Ricketts, Arthur H. Elliott, C. F. Chandler.

Accepted unanimously and referred to Committee on Nominations.

Dr. Behr then read the first paper announced for the evening, as follows:

"A New Specific Gravity Bottle." By Wm. H. Gregg.

Dr. Squibb, in discussing the paper, described the specific gravity bottle used by him. Mr. Casamajor described the specific gravity bottle which he employed.

Dr. BEHR then read the second paper announced for the evening, as follows:

"On the Solvent Action of Carbonic Anhydride in Solution, upon Various Bodies, under Different Conditions as to Temperature and Pressure." By T. H. TUCKER.

Dr. SQUIBB remarked that water at a sufficiently high temperature decomposes bicarbonates in solution. There is a dissociation in a narrow limit of temperature, and the carbonate of the salt is deposited.

Mr. CASAMAJOR announced that he had received a paper from Dr. THOMASSIE on the "Dissocioscope." He stated that this paper had already been published in the *Chemical News*. Referred to the Committee on Papers and Publications.

Mr. CASAMAJOR read a paper on the production of sulphuretted hydrogen by electrolysis, caused by the presence of zinc amalgam and sulphide of iron.

Mr. STEBBINS then read a paper "On Certain New Diamido-compounds."

Dr. LEEDS then made some remarks on the action of peroxide of hydrogen on ammonia. The ammonia is oxidised, producing nitrous acid.

Then followed a discussion by several members on different methods of testing for nitric and nitrous acids, in presence of each other.

Dr. LEEDS moved that hereafter the nights on which the regular meetings and the conversaziones were held, should be changed to Friday. The regular business meeting to be held the first Friday of the month, and the conversazione on the third Friday of the month. Carried unanimously.

Mr. CASAMAJOR moved that the Society have an annual dinner, the time thereof to be fixed by a committee to be appointed. Carried unanimously.

Mr. CASAMAJOR moved that the Chair appoint a committee for the next annual dinner. Carried unanimously.

The Chair appointed as said committee Mr. CASAMAJOR and Dr. ALSBERG. Adopted unanimously.

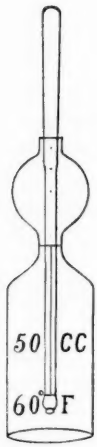
On motion the Society adjourned.

ALBERT H. GALLATIN,
Recording Secretary.

VII.—A New Specific Gravity Bottle.

By Dr. W. H. Gregg.

In taking the specific gravity of corrosive and volatile fluids, the ordinary specific gravity bottle presents some objections. The stoppers are usually perforated, with a view of affording a full passage for the excess of fluid when the stopper is inserted into its place. This is very objectionable with corrosive fluids, such as oil vitriol, and such volatile fluids as ether, chloroform, etc.



For such substances, a modification of Regnault's specific gravity bottle is presented, which does not allow any overflow of its contents when the stopper is inserted, and at the same time a thermometer is at hand to note the temperature. Such a bottle is shown in the figure. The neck is drawn out as in Regnault's, and marked to indicate its capacity. A short distance above the mark the neck swells out sufficiently to contain an amount of fluid equal to that displaced by the thermometer tube. The thermometer is attached to the stopper which is ground into the neck at the top as on the ordinary bottle, to prevent loss by evaporation.

Elmira, N. Y.

VIII.—On the Solvent Action of Carbonic Anhydride in Solution, upon Various Bodies, under Different Conditions as to Temperature and Pressure.

By J. H. Tucker, Ph.D.

It is well known that carbonic acid gas in solution, is capable of exerting a great chemical influence upon the materials forming the earth's crust, and as the air and all natural waters are impregnated with it, the range of its action is necessarily extensive. Among the bodies thus acted upon by carbonic acid, may be mentioned the carbonates and silicates as the most important. The insoluble carbonates are dissolved, soluble bicarbonates being formed, the extra equivalent of carbonic acid being given up again on heating the solution. The silicates are decomposed, the base is converted into carbonate or acid carbonate, the silica remaining insoluble; the decomposition or "rotting" of feldspathic rocks is a prominent example of this. In addition to the compounds mentioned, the tribasic phos-

phates of lime and magnesia, the fluoride of calcium and phosphate of alumina, are known to be soluble in a solution of carbonic anhydride. It has been claimed that silica in the hydrated state is soluble, but the results of my experiments with ferrous silicate, as far as they go, seem to negative that claim. There is good ground, however, for believing that a large number of the constituents of rock masses are decomposed by carbonic acid, and it will be the chief object of an extension of this investigation to examine these decompositions, and determine their quantitative relations.

As far as I am aware,* the only work that has been done on this subject in a quantitative way, has been principally by Bischoff (*Chemical and Physical Geology, English Ed.*), who has limited his experiments mostly to the carbonates of lime and magnesia, which were performed only at a single temperature and pressure. Lassaigne (*Journ. Chim. Med.*, 1848, 312) states that water saturated with carbonic acid, dissolves $\frac{1}{1128}$ part of calcic carbonate at 0° C., and $\frac{1}{1156}$ part at 10° C.; and Warrington (*Journal Chemical Society*, 2, **9**, 80) states that one part of calcium phosphate in calcined bone-ash, dissolves on the average in 6788 parts of the saturated water.

In view of the importance of the *role* played by carbonic acid in geological changes, and the modifying influence which we know differences of temperature and pressure exert upon its action, I have thought it would be useful to make quantitative determinations of the solvent action on various bodies at varying temperatures and pressures. The following is the method adopted to carrying on the experiments: At ordinary pressure, the purified gas was passed into distilled water containing a large excess of the substance under examination, in a minute state of division, the passage of the gas being continued for six or eight hours until it ceased to be absorbed.

For the pressure effects, the finely divided substance was diffused through water; the gas passed at ordinary pressure for an hour, and then the whole exposed to a pressure of one atmosphere for six to eight hours, the containing vessel being frequently agitated to aid the absorption of the gas. The results obtained at 0° C. were by artificial cooling with ice.

Ferrous Carbonate.

I. *At 0° C.*—1. Well washed hydrated ferrous carbonate, only slightly oxidised, was diffused through distilled water and the gas passed:

* Schloesing, *Journ. Chem. Soc.* 2, **10**, 788; Cossa, *Zeitschr. f. Anal. Chem.*, 1869, 145.

After $1\frac{1}{2}$ hours, one liter of solution contained 1.308 grm $FeCO_3$.
" 3 " " " " " 1.632 " "
" $4\frac{1}{2}$ " " " " " 2.332 " "
" 6 " " " " " 2.594 " "

2. In another experiment, the gas was passed for $4\frac{1}{2}$ hours when one liter of solution contained 2.512 grms $FeCO_3$.

II. *At ordinary temperature.*—Conditions as above :

Time, eight hours. One liter of solution contained :

At 23° C., 1.046 grm $FeCO_3$.
At 21° C., 1.134 " "

III. *Under pressure.*—One liter of solution contained :

(1.) 1.520 grm $FeCO_3$.
(2.) 1.374 " "

Siderite.—A well crystallized specimen was reduced to fine powder and treated as above at 24° C., under atmospheric pressure. One liter of solution contained : 0.480 grm $FeCO_3$.

Calcium Carbonate.

I. *At 0° C.*—The carbonate used was formed by precipitating a solution of calcium chloride.

One liter of solution contained : 2.444 grms $CaCO_3$.

II. *At ordinary temperature.*—One liter of solution contained at 28° C., 0.894 grm $CaCO_3$.

III. *Under pressure.*—One liter of solution contained at 21° C., 1.1824 grm $CaCO_3$.

IV. *Marble.*—Ordinary crystalline marble was finely powdered and submitted to the action of the gas :

At 22° C., and under ordinary pressure, one liter of solution contained 1.036 grm $CaCO_3$.

Magnesium Carbonate.

I. *At 0° C.*

II. *At 30° C.*—One liter of solution contained 10.676 grms $MgCO_3$.

III. *Under pressure.*—One liter contained, at 26° C., 18.520 grms $MgCO_3$.

The carbonate operated upon was obtained by precipitating a solution of magnesic sulphate at boiling temperature, with sodium carbonate.

Ankerite.

(Carbonate of lime, magnesia and ferrous oxide.)

Native ankerite consisting of the powdered crystals, was treated with carbonic acid gas at 25° C., in the usual way, under ordinary pressure.

One liter of solution contained 0.318 grm $CaCO_3$, 0.313 grm $MgCO_3$, with a little $FeCO_3$.

It will be observed that the relative amounts dissolved of the calcium and magnesium salts, are very different from those dissolved when the salts are operated upon separately.

Manganese Carbonate.

Artificial hydrated Carbonate.

At 0° *C.*—One liter of solution contained 0.396 grm $MnCO_3$.

At 26° *C.*—One liter of solution contained 0.239 grm $MnCO_3$.

Under pressure, at 23° *C.*—One liter of solution contained 0.376 grm $MnCO_3$.

Tribasic Phosphate of Lime.

In the hydrated state, prepared by precipitating a solution of calcium chloride with sodium orthophosphate.

At 25° *C.*—One liter of solution contained 0.396 grm anhydrous phosphate.

Under pressure, at 28° *C.*—One liter of solution contained 0.464 grm anhydrous phosphate.

Pure Hydrated Alumina

Exposed to the action of the gas in the usual manner, showed not the slightest solubility under any temperature and pressure.

Hydrated Silicate of Protoxide of Iron

Prepared by precipitation, was exposed to the action of the gas at 23°C. and ordinary pressure.

One liter of resulting solution contained 0.330 grm $FeCO_3$.

On careful testing of the same solution, no trace of silica was found.

From these results it may be observed :

1. That difference in temperature produces a marked difference in the amount carried into solution ; the lower the temperature, the more being dissolved.

2. That increase in pressure causes a considerable increase in matter dissolved, though the effect is not so great as in the case of

change in temperature; carbonate of lime seems to be an exception to this, increased pressure appearing to make little difference.

3. Substances in the native state, as compared with those artificially prepared, are, as would be expected, less soluble, but they are sufficiently soluble to fully account for the profound geological changes that have been produced by carbonic acid gas.

IX.—Note on Sulphuretted Hydrogen.

By P. Casamajor.

In 1873, Mr. William Skey, Analyst to the Geological Survey of New Zealand, published some interesting observations* on the production of sulphuretted hydrodgen, when a voltaic couple is formed with zinc as the positive, and a metallic sulphuret as the negative plate. When placed in contact with zinc, or in communication with this metal, by means of a wire, many sulphurets give sulphuretted hydrogen very freely, with sulphuric or hydrochloric acid, which alone would not give any in contact with these acids. This happens with galena and sulphuret of copper.

I have had occasion lately to apply these researches of Mr. Skey to the production of sulphuretted hydrogen from sulphuret of iron, which refused to give it in the presence of sulphuric acid diluted with ten times its volume of water. I believe that the greater part of the sulphuret of iron sold to chemists possesses this resistance to acids. I have found none lately which gave sulphuretted hydrogen easily, and I had accumulated several pounds lately possessing this undesirable quality.

After a few trials I was able to obtain an abundant supply of sulphuretted hydrogen from any sample of sulphuret of iron, by proceeding as follows: Enough mercury is put in a bottle to cover the bottom entirely. Over this diluted sulphuric acid is poured, and some pieces of zinc are thrown in, which immediately sink in the mercury, forming a zinc amalgam with great excess of mercury. No action takes place between the zinc and the acid. If now a few pieces of sulphuret of iron are thrown in the bottle, they will sink to the mercury, and a copious discharge of sulphuretted hydrogen will take place from the surface of the sulphuret of iron. This production will continue with remarkable regularity until either the zinc, the sulphuret of iron, or the sulphuric acid is exhausted. As to the mercury, it

* *Chemical News*, **27**, 161.

only intervenes indirectly in the reaction, and it does not require to be renewed.

In place of sulphuret of iron I have tried galena, iron pyrites and copper pyrites. These all give sulphuretted hydrogen, but very slowly. With galena the action soon ceases as the mineral becomes coated with sulphate of lead. By leaving galena in contact with the zinc amalgam for several hours, its surface becomes coated with bright lead amalgam.

With iron and copper pyrites comparitively little sulphuret of hydrogen is given off, but there is a considerable production of hydrogen. In this case the sulphurets act mainly as conductors, in the same manner as a piece of retort carbon.

THE AMERICAN CHEMICAL SOCIETY.

X.—Proceedings.

Regular Meeting, April 1st, 1881.

At 8:20 P.M. the meeting was called to order by Vice-President Leeds.

Twelve persons were present.

Dr. Leeds stated that all business would be deferred until a quorum should be present.

In absence of Mr. Pitkin, the second paper of the evening: "On Anilometallic Compounds" was read by Dr. Leeds.*

Mr. Stebbins stated that he had made an aniline and calcium compound in the presence of water.

The Recording Secretary announced that a quorum was now present.

The minutes of the March meeting were read by the Recording Secretary. Adopted after sundry corrections had been made.

The following gentlemen were nominated as new members:

A. Howard Van Linderen, associate member.

Nominated by { Arthur H. Elliott, T. O'Connor Sloane, J. B. Herreshoff.

C. P. Sawyer, associate member.

Nominated by { Arthur H. Elliott, Elwyn Waller, P. Casamajor.

Dr. Otto Grote.

Nominated by { Bernard G. Amend, S. A. Goldschmidt, Jas. H. Stebbins, Jr.

Mr. A. E. Hoppock, of 103 East 148th street, was unanimously elected a member of the Society.

Mr. Casamajor, who had been appointed a committee of one at the last meeting to select a new Recording Secretary, announced that he had selected Mr. Jas. H. Stebbins, Jr., as Recording Secretary. It was moved and recorded that this report be adopted. Carried unanimously.

*Withdrawn by the Author.

Mr. CASAMAJOR then announced that he had selected Mr. J. B. HERRESHOFF to take the place of Mr. STEBBINS on the Committee of Nominations. It was moved and seconded that this report be adopted. Carried unanimously.

Mr. CASAMAJOR then made the report of the Committee on the Annual Dinner.

It was moved and seconded that the annual dinner should take place on Saturday evening, the 16th day of April, at 5 P.M. Carried.

Mr. PITKIN read his paper entitled: "Action of Concentrated Sulphuric Acid on Lead Alloys."*

A long discussion followed participated in by various members.

Mr. ARTHUR H. ELLIOTT moved to reconsider the action on the motion to have the annual dinner on Saturday evening, the 16th of April. Seconded and carried.

It was then moved and seconded that we do hold our annual dinner on Monday evening, the 18th of April, at 6 P.M. Carried unanimously.

On motion, the Society adjourned.

ALBERT H. GALLATIN,
Recording Secretary.

* This paper has, at the time of publication, not been received by the Com. on P. and P.

THE AMERICAN CHEMICAL SOCIETY.

XI.—Proceedings.

Regular Meeting, May 6th, 1881.

The meeting was called to order at 8:30 P.M., Prof. Leeds in the chair.

In the absence of a quorum, the regular business was deferred till one should be present.

The first paper of the evening, "On a Slight Modification of Wilkinson's Gas Eudiometer" was read by Mr. Jas. H. Stebbins, Jr., S.B.

Prof. Doremus then remarked that the trouble encountered with the Wilkinson eudiometer might be overcome by first filling with gas and then letting in a little water, and finally making allowance for the water level.

The second paper of the evening, "On the Purification of Baric Sulphate," by. T. O'Connor Sloane, Ph.D., was then read.

The third paper of the evening, "On a Qualitative Test for Carbon Disulphide and Carbon Dioxide in Coal Gas," by T. O'Connor Sloane, concluded the reading of papers.

The Recording Secretary then announced that a quorum was present.

The minutes of the last meeting were then read and approved.

Mr. Casamajor objected to the mention of particulars concerning annual dinner, and thought that only a general description in place of minute particulars would be preferable.

Dr. Squibb then stated that he thought that the minutes concerning the annual dinner as taken by the Recording Secretary, should not be altered, but, that minute particulars should be left out of printed report.

This being put to motion, was carried unanimously.

Dr. Goldmark's death was then mentioned by the chair.

Dr. Squibb moved that a committee of one be appointed to draw up a short obituary notice on Dr. Goldmark's death.

On motion, this was carried unanimously.

The Recording Secretary then read the minutes of the last meeting of the Board of Directors, which, after a small correction, were approved.

The Recording Secretary then read Dr. MOORE's resignation as Editor of the JOURNAL OF THE AMERICAN CHEMICAL SOCIETY.

After sundry remarks by Messrs. SQUIBB, LEDOUX and CASAMAJOR, Dr. DOREMUS moved that a committee, consisting of Drs. A. R. LEEDS and A. R. LEDOUX, be appointed to report in regard to filling vacancy caused by Dr. MOORE's resignation.

This being put to motion, was carried unanimously.

The chair then brought up the question in regard to filling the vacancy in the Board of Directors, caused by the death of Dr. GOLDMARK.

After some remarks by Messrs. SQUIBB, ELLIOTT and CASAMAJOR, it was finally moved and seconded that the previous committee, consisting of Drs. A. R. LEED and A. R. LEDOUX, should also investigate the legality of the election of a Director to fill the vacancy in the Board of Directors, caused by the death of Dr. GOLDMARK, and should report at the next meeting, presenting at the same time the name of a person to fill the vacancy, and that the Recording Secretary should insert a notification to this effect on next postal cards.

On motion, this was carried unanimously.

The following gentlemen were then elected:

C. P. SAWYER, associate member.

Nominated by { ARTHUR H. ELLIOTT, ELWYN WALLER, P. CASAMAJOR.

A. HOWARD VAN LINDEREN, associate member.

Nominated by { ARTHUR H. ELLIOTT, T. O'C. SLOANE, J. B. F. HERRESHOFF.

Dr. OTTO GROTE, as member.

Nominated by { S. A. GOLDSCHMIDT, BERNARD G. AMEND, JAMES H. STEBBINS, Jr.

THOS. TONNELÉ, as member.

Nominated by { P. DE P. RICKETTS, ARTHUR H. ELLIOTT, C. F. CHANDLER.

J. G. MATTISON, as member.

Nominated by { P. DE P. RICKETTS, ARTHUR H. ELLIOTT, C. F. CHANDLER.

Mr. A. P. HALLOCK, Ph.B., was then nominated as a regular member, by T. O'C. SLOANE, Mr. BENJAMIN and WM. RUPP.

The fourth paper of the evening, "Upon the Direct Conversion of Aromatic Amides into their Corresponding Azo-compounds," by Dr. A. R. LEEDS, was then read.

After some questions by Mr. STEBBINS, the fifth paper of the evening, "On the Chemical Contents of the Fluid Cavities of Minerals," by Mr. A. A. JULIEN, was then read.

Some remarks by Messrs. ELLIOTT and DOREMUS then followed.

On motion, the Society adjourned.

JAMES H. STEBBINS, JR.,
Recording Secretary.

XII.—ON A SLIGHT MODIFICATION OF THE WILKINSON GAS EUDIOMETER.

BY JAMES H. STEBBINS, JR.

At one of our previous meetings, Prof. Doremus read a paper and exhibited to you one of Wilkinson's eudiometers, with which, I think, he said very fair gas analyses might be made.

Now, although I do not wish to contradict Prof. Doremus' statement, still I feel bound to say, that my experience with the above apparatus for the past month has been anything but satisfactory, and I now make bold enough to say that the Wilkinson gas eudiometer, as it is now made, cannot possibly give correct results, and with the greatest care, only approximate answers can be obtained.

The reason of this is obvious and can readily be explained by the following diagram:

The usual Wilkinson eudiometer has quite a long and thin neck just under the glass cock as may be seen in the diagram, and which I represent as *a* and *b*.

Now, in filling this burette, we have to first fill it with water, which drives all the air out, and then connect it with the rubber tube conveying the gas. As soon as we open the cock, the gas flows in, which we so regulate as to get down to the zero mark, and then turn off the valve. In this way we get just 100 c.c. of gas. Now

the trouble begins, for the moment we let our absorbing fluids flow in, the narrow neck of the eudiometer is immediately filled with the liquid, and naturally drives the gas down below the zero mark, thus causing much trouble and annoyance. Now Prof. Doremus will say that this difficulty can easily be overcome by first letting pure water run into your burette, then marking the expansion caused, and finally making allowance for this expansion after we begin to absorb our different constituents.

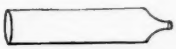
But I will here remark that, as soon as our water level has fallen below zero, it is almost impossible to make accurate readings with the naked eye, which can only be done with a telescope having cross hairs, and such a thing as this for quick work is entirely out of the question.

Therefore, to get rid of all this trouble, I have done way with the long neck, and have had a eudiometer made with the glass cock soldered directly on to the top of the burette.

This burette is divided into 100 c.c. and $\frac{1}{10}$ of c.c., thus permitting me to make very close readings.

The *modus operandi* of this instrument is the same as in the previous case, and the analyses obtained are approximately correct.

The modification here mentioned may be better understood by the following diagram :



XIII.—1. Note on the Precipitation and Purification of Barium Sulphate. 2. Qualitative Test for Carbon Disulphide and Carbon Dioxide in Coal Gas.

By T. O'Connor Sloane, A.M., Ph.D.

1.

To obtain a precipitate of barium sulphate that will not run through the filter paper, the following rules should be observed : The solution should be barely acid. This end is best secured by the use of cochineal or some equivalent solution. By using the colored matter in the fluid form, a solution can be neutralized in quarter of the time, and with far more exactness than when its reaction is tried

with litmus paper. The precipitant is added when the solution is nearly boiling, and the liquid is kept at that temperature for some time. A heavy precipitate will be formed with perfectly clear supernatant liquor. It is quite certain, if any iron be present, that some will be carried down, and the ignited barium sulphate will not be white. Many ways of treating the precipitate after ignition have been recommended. I will refer to only two in the hurried way. The first is, to boil it with dilute hydrochloric acid ; the second, to boil it with concentrated sulphuric acid ; then dilute and filter. If the first course be pursued, any barium sulphide present will be dissolved, thus causing a loss. This is quite a common case, as the filter paper reduces the sulphate in the ignition. If treatment with concentrated sulphuric acid be adopted, any other salts of barium present will be rendered insoluble, and excess of weight be caused. In the dry way, fusion with sodium carbonate and a little sodium nitrate, and subsequent determination of the sulphuric acid, may be recommended as very efficacious ; but it is troublesome.

Some time ago I had occasion to make a great many sulphur determinations in coal. I was much annoyed by the precipitation of iron with the barium sulphate. I adopted the following simple method of purification, and it always secured a perfectly white precipitate :

The sulphuric acid was precipitated with great care, as already described, so as to obtain a clear supernatant fluid. The solution was decanted to the last drop through a filter paper. To the precipitate left in the beaker were added five or ten cubic centimeters of concentrated hydrochloric acid. The beaker was then carefully held over and just touching a hot plate, until the acid was in full ebullition. By holding the beaker in an inclined position there will be no danger of spirting. The boiling was kept up for about a minute. After cooling, it was diluted, cochineal solution added, overneutralized with ammonia, slightly acidified and filtered. This always gave perfectly white precipitates.

2.

A piece of caustic potash a few mms long is dissolved in 10 to 20 c.c. of alcohol. If, after standing protected from the air, a homogeneous and clear solution remains, it is ready for use. Otherwise, after settling, the clear fluid may be decanted. It is placed in a suitable absorption tube and a cubic foot or more of gas passed through it. It is then poured into a test tube. If the gas contained carbonic acid, an oily-looking colorless solution of potassic carbonate

in water will underlie the alcohol. This last will be colored more or less.

The alcoholic solution, if any carbon disulphide was in the gas, will contain a so-called xanthate of potash, and may be boiled and tested for sulphuretted hydrogen.

A more demonstrative method is to add excess of copper salt, filter out the precipitated cupric compounds, and pour ammonia through the filter paper, when a highly characteristic precipitate of cupric xanthate will remain on the filter paper.

XIV.—Upon the Direct Conversion of the Aromatic Amides into their Corresponding Azo-compounds.

By Albert R. Leeds.

I have already published in another place (Journal American Chemical Society, 3, 16,) the results obtained by the action of hydrogen peroxide upon benzene. The latter is gradually converted into phenole-oxalic acid, and a small amount of a yellow coloring matter being formed at the same time.

Phenole itself is but slightly acted upon by hydrogen peroxide in the cold, but at the boiling point undergoes conversion into a tarry substance.

Naphthalene, when digested with hydrogen peroxide, yields a small amount of naphthole. Naphthole itself is not affected to any notable extent by hydrogen peroxide in the cold, but at the boiling point is changed to a tar.

When anthracene is dissolved in glacial acetic acid, and the precipitate obtained on the addition of solution of hydrogen peroxide is digested with excess of the latter re-agent, the anthracene is slowly converted into anthraquinone. Three grms of anthracene, boiled for three days with hydrogen peroxide, in a flask attached to a return-cooler, were changed almost entirely into anthraquinone, the brown coloring matter formed at the same time being too small in amount to permit of its being experimented upon successfully.

Benzenesulphonic acid was slightly acted upon, a brown color being imparted to its solution after boiling for a number of hours with hydrogen peroxide, and the acid crystallising out from the liquid in small colorless crystals, identical in appearance with the original body before its treatment with peroxide.

The preceding results show that in certain cases hydrogen peroxide operates upon organic bodies by the substitution of hydroxyl; in other cases, by direct oxidation, and in the third place, by both actions combined.

The experiments were therefore extended to the aromatic amides with the hope that hydroxylated derivatives of these compounds might be obtained. The amide was converted into the acetate, or when this not possible, it was dissolved in excess of glacial acetic acid, and a solution of hydrogen peroxide, containing 1.2 per cent. of peroxide, added in successive portions. Heating of the liquid had to be avoided, the amide in every instance being changed to a tarry substance. This result indeed happened in most instances, even when the experiment was conducted at common temperatures or with gentle warming. The following is a brief summary of the results obtained with the compounds thus far operated upon :

Diphenylamine yielded a large amount of a black liquid and a black tar.

Dimethylaniline gave a very dark red liquid with a black residue soluble in alcohol.

Xylidine formed a claret colored liquid with a blackish residue dissolving in alcohol to a dark purple solution.

Naphthylamine gave a rose colored liquid with a brownish-black residue.

Similar results were obtained with orthotoluidine, the solution acquiring a ruby color, and a blackish tarry residue soluble in alcohol being formed.

Failing to obtain by careful sublimation, or by treatment with ligroine, alcohol and other solvents, any crystalline bodies from the above products, their further study was abandoned.

Aniline and paratoluidine acted differently. The solutions of their acetates in hydrogen peroxide quickly threw down on gentle warming, copious precipitates of a brownish crystalline appearance. At higher temperatures there was a formation of tar. The precipitates came down principally on the first treatment with the peroxide. On filtering them off and adding an amount of the peroxide in excess of the calculated quantity, the second crop of crystals was small, and the larger portion of the aniline or paratoluidine acetate remained behind in the solution.

The precipitates, after washing and drying, were sublimed very slowly, since the small amounts of accompanying tarry matter interfered seriously with the operation when the temperature was not carefully regulated at the lowest practicable point. The sublimate from the paratoluidine formed yellow needles, some of them exceeding two inches in length. They were repeatedly crystallised from alcohol, in which they are not very readily soluble, and were finally

obtained as magnificent orange needles. Their melting point was 143–144°.

0.2806 grm of the substance yielded on combustion 0.8123 grm carbonic acid and 0.1763 grm water. These results agree with those calculated on the supposition that the body is azotoluole, $C_{14}H_{14}N_2$:

	Calculated.	Found.
Carbon	80.00	79.28
Hydrogen	6.66	6.98
Nitrogen	13.34	13.51

The same body has recently been obtained by Barsilowsky* by the action of very dilute potassium permanganate solution upon toluidine sulphate. This reaction yielded a very small product, and Barsilowsky afterwards used a solution of potassium ferricyanide and caustic potash with better results. The orange crystals thus obtained melted at 144°, and were identical in their physical properties both with the parazotoluene, derived by Petrieff from the reduction of nitrotoluene, and with the substance described by the author. By the action of hydrogen peroxide, therefore, upon paratoluidine it is converted directly into parazotoluene.

The sublimate from the aniline product yielded large red crystals, together with some accompanying yellow oil. This sublimate had a melting point of 66°, showing that the body was azotoluene (m. pt., 66°.5).

XV.—On the Examination of Carbon Dioxide in the Fluid Cavities of Topaz.

By Alexis A. Julien.

Literature.

Sir David Brewster. See for ref., J. D. Dana, system of Mineralogy, articles Brewsterlinite and Cryptolinite; also *Phil. Mag.*, 1847, 3, **31**, 497; 1853, 4, **5**, 235, etc.
R. Th. Simmler. *Pogg. Ann.*, 1858, **105**, 460.
H. Vogelsang and H. Geissler. *Pogg. Ann.*, 1869, **137**, 56.
Isaac Lea. *Proc. Ac. Nat. Sci.*, Phil., May, 1876.

Recent studies of the fluid contents of the cavities of minerals, especially of the fluids separated in sufficient quantities for analytic examination, have established more definite views concerning their true character. The liquid first observed by Brewster in Brazilian topaz, and which has since passed by the name Brewsterline or Brewsterlinite, has been shown by Simmler, Vogelsang and Geissler,

Ann. der Chem.*, **207, 102.

and W. N. Hartley,* to be identical in its properties with liquid carbon dioxide. The abundant dissemination of this substance has been variously and certainly confirmed through its general optical and physical properties, especially by the determination of its refractive index, by spectroscopic examination of the gas after expulsion into a Geissler tube, and even by ordinary qualitative or volumetric examination.

The dense and darker liquid commonly associated with this, first noticed by Brewster, and afterwards styled cryptoline or cryptolinite, as well as another liquid, still more thick and viscid, subsequently observed in a large cavity,† are now recognised merely as saline solutions of varying composition.

These two names are now obsolete, but the following substances may be accepted as entering into the content of these cavities in the various siliceous minerals: water, liquid and as vapor, and frequently in the form of supersaturated saline solutions, containing chlorides, sulphates, or carbonates of the alkaline metals, fluoride and sulphate of calcium, and sulphate of barium, some of these salts, especially the chlorides, being often isolated in minute crystals; carbon dioxide, liquid and gaseous nitrogen, solid bitumen, mineral oil,‡ and perhaps lighter hydrocarbons; free sulphuric and hydrochloric acids; hydrogen sulphide; and minute crystals, microliths, and trichites, representing usually the constituent minerals of the enclosing rock, *e. g.*, hornblende, rutile, etc. Sulphurous oxide and free ammonia have been also detected in the gases expelled from the cavities by ignition,§ but may have originated in the decomposition of solid or liquid bituminous matters, such as those first noticed by Foster in smoky quartz; their actual presence in the included gases is yet to be confirmed by examination of the latter, when separated without adulteration, by products of distillation, *e. g.*, by mechanical means, as when crushed in a vacuum. Several other soluble substances of limited occurrence have been noted in the study of special minerals, *e. g.*, magnesium and calcium chlorides in the cavities of halite, zinc sulphate with sodium chloride in those of blende,‖ etc.

In the siliceous sedimentary and metamorphic rocks, especially in all the gneisses of the Appalachians, in the Eastern United

* *Journ. Chem. Soc.*, London, 1876.

† Brewster, *Phil. Mag.*, 1853, 4, **5**, 235.

‡ Brewster, *Trans. Roy. Soc.*, Ed., **10**.

§ A. W. Wright, *Amer. Journ. Sci.*, 1881, 3, **21**, 212.

‖ A. Schertel, *Berg und Hüttenm. Zeitung*, 1878.

States, the quartz grains generally abound in cavities, holding apparently pure water, but sometimes a saline solution with minute cubical crystals. For instance, I have found certain specimens of the triassic brown sandstone of Portland, Conn., to be remarkably rich in these fluid cavities, not only the quartz but even all the feldspar grains being saturated by them to such a degree, that they abound in every field of view throughout the thin section.

Carbon dioxide so far appears to be of much rarer occurrence in the rocks of Eastern America, having been detected mainly in quartz, and only at the following localities: in the labradorite of Labrador; in hornblende-syenite at Columbia, N. H.;* in the pegmatyte vein at Branchville, Conn.;† in the granulyte at Charlotte, N. C., and in the smoky quartz at White Plains, N. C.;‡ in the hornblende-gneiss of the Laurentian at Ticonderoga, N. Y., and in the same rock at three localities in Western N. C.; in the gneissoid-granyte of the Penokie Iron Range, Wis.,§ and in granyte, mica-schist, hornblende-schist, and chlorite-schist, at three localities in Mich.‖

In the metamorphic and eruptive rocks of Western America, however, carbon dioxide, together with a second liquid, which is either water or a saline solution, occupies the cavities of the quartz grains at many localities—in the gneisses, granyte and granyte-porphyry of Marble Hill, Kinzly District, of Clover Cañon, Humboldt Mts., of Havallah Range, and of Granite Peak, Ute Range, Nev.; in the hornblende-gneiss at Davis Mt., Park Range, and in the quartz-propylyte at Golconda, Col.;¶ in the smoky quartz of Pike's Peak, Col.,** and in the quartz from the gold vein at Hunter's Rest, Arizona.†† These few localities, however, must undoubtedly represent a far wider distribution of this interesting substance throughout the rocks of the continent, as their number is being constantly increased with every published report of lithological work.

The qualitative identification of carbon dioxide in the cavities of a mounted thin section of a mineral, may be determined, at least with probability, after some experience, through various optical appearances and physical characteristics which have been often described.

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* G. W. Hawes, *Geol. of N. H.*, 1878, **3**, 207.
† A. W. Wright, *loc. cit.*
‡ G. W. Hawes, *Amer. Journ. Sci.*, 1881, 203.
§ R. D. Irving, *Geol. of Wis.*, 1880, **3**, 249.
‖ A. Wichmann, *idem*, 600, 619, 635, 642, 647.
¶ F. Zirkel, *Geol. Expl. of 40th Par.*, 1876, **6**, 18, 33, 44, etc.
** B. Silliman, *Science*, 1880, **1**, 289.
†† G. W. Hawes, *Amer. Journ. Sci.*, 1881, 203.

It is usually effected with certainty and ease, through the rapid and enormous expansion and ultimate disappearance, either of the liquid or of the gaseous bubble, on the application of a gentle heat for a few seconds, such as that of a cigar, the heated end of a rod, a jet of hot air, or even a jet of the warm breath conveyed through a flexible rubber tube. When the slide and the thin section are thin, even the heat (37° C.) of the tip of one's finger applied for a few seconds to the bottom of the slide, without removal from the stage of the microscope, may be sufficient to produce the characteristic phenomena, *e. g.*, the contraction and disappearance of a bubble whose size is relatively small to that of the liquid in which it floats.

For the determination of the temperature of disappearance of the bubble, which may vary from 20° to 32° C., several forms of stage-heating apparatus may be employed: those of Nachet, L. Beale, and R. Fuess, in which a current of hot air from the flame of a small lamp or taper is conveyed beneath both the slide and the adjacent bulb of a thermometer; that of M. Schultze (also Chevalier, Dujardin, and Dr. Ransom), in which both slide and thermometer bulb are heated by conduction through a brass or copper plate, with two arms projecting beyond the stage over the flames of two tapers; those of Polallion and Ranvier, in which the slide rests upon the upper side of a metal box through which a continuous current of hot water is conveyed through tubes in connection with a small adjacent tank or boiler, the bulb of the thermometer being immersed in the box; and that of H. Vogelsang, in which the slide rests upon a ring-shaped thermometer bulb, with a fine and frequently bent platinum wire intervening, which is heated by a galvanic current under the control of a rheostat. The results obtained by any apparatus of these kinds are inexact, from the unequal and irregular application of heat to the thin section and to the thermometer bulb, from the interference of cooler currents in the surrounding atmosphere, and above all, from the refrigerating effect of the mass of metal of the microscopic objective in close approximation. Vogelsang admitted that with his apparatus, the one even yet considered the most accurate, from this last source the error may amount to 10°, according to the objective employed, from a No. 4 Hartnack, of 3 mms focal distance, to a No. 9 of 0.1 mm focal distance. He reduced observations with the higher powers to the standard of the No. 4, and further suggested a plus correction of 1° for those observations in which the temperature of the room and of the microscope remained at 12° to 15°, instead of his normal, 20° C. Most of the published observations on the subject

have been consequently made under the lowest powers, and it is considered sufficient to obtain results corresponding to a degree. In every case there are also additional obstacles in the inconvenience, fragility and cost of the apparatus; much time is required for satisfactory experiments, and especial annoyance is incurred by the slowness with which the apparatus cools before the temperature of the re-appearance of the bubble can be determined, as a check.

In place of all these a simple and inexpensive apparatus may be substituted, consisting of a miniature water bath in which are immersed the entire section and slide, the bulb of the thermometer, and the nose of the objective. It consists of a box of tinned copper

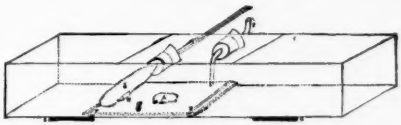

Fig. 1.

(tinned iron is liable to rust), of length sufficient to project a few centimeters on either side of the stage of the microscope employed; the one I use being 23 centimeters in length, 4 cms in width, and 3 cms in depth. This is laid across the stage of the microscope, separated from the metal by thin plates of cork, *c c*, and is heated by a short wax taper (night light) underneath either extremity. The slide *s* may rest upon the bottom guarded from the metal by little rubber bands, *r r*, beneath its ends, and wedged firmly by a little wooden wedge, *w*, beneath the horizontal thermometer bulb, *b*; or, a thermometer with ring-shaped bulb may be inserted, upon which the slide may rest directly, firmly attached by one or two slender rubber bands. The thermometer should be of guaranteed accuracy, with wide degrees, subdivided if possible, with a range which need not much exceed 20 to 32° C. The preparation is then covered by any pure and clear water, preferably filtered (distilled is unnecessary), to a depth of about 2 cms. A circular aperture in the bottom of the box 18 mms in diameter, is covered with glass attached by cement, and through this the light is thrown up from the mirror. The cavity to be examined is then carefully adjusted and focussed, a taper is lit, and the eye remains at the eye-piece until the critical point is reached. The glass tube *t*, with its point terminating just below the edge of the slide, is connected with the mouth during the experiment by a small rubber tube. As the temperature slowly

rises, a constant current of small bubbles of the warm breath (whose temperature, 32°, only assists the operation) may be blown with little fatigue through the tube to effect a thorough intermixture of unequally heated layers in the water stratum. The determination of the temperature of disappearance of the bubble is easily obtained within five minutes, and that of its re-appearance in about the same time. A low power objective may be carefully wiped if its anterior lens is dimmed by flying drops or by rising vapor, when a high temperature is being attained; but it is best to insert the whole objective in a small narrow glass beaker floating upon the surface of the bath over the preparation.

The plan of immersing the preparation at once in a bath previously heated, and then allowing it to cool under observation, has already been used with indifferent results. Brewster "plunged the topaz in heated water," and thus determined the point of re-appearance of the bubble at 26°.4 C., and, in another deep cavity, at 28°.8 C. Vogelsang placed it in 6 to 8 c.c. of glycerine, previously warmed to 60°, in a layer 4 to 5 mms in depth above the preparation; this he stirred up with a slender thermometer, which, however, greatly interfered with observation. He obtained the following results, corresponding to the Hartnack objectives employed, for the temperature of re-appearance of the bubble:

Objective No. 4, ocular No. 3,	lens above the liquid .	31°.5-(32)
" " 4, " " 4, "	just in the liquid .	.34°.5-(36)
" " 7,	hardly down to .	45°.

As the range of error amounts to 13°, even without the use of an objective of much power, he recommends the employment in this method of such an objective as will remain above the liquid, but considers his galvanic apparatus as preferable. Sorby* explains that he examined the fluid cavities in sapphire, by immersing the preparation in a beaker of water, under a low power of the microscope, and raising its temperature very slowly, but gives no details concerning the method or the accuracy of his results. A bath may, indeed, be heated up by repeated additions of small quantities of warmer water, but this process is apt to be tedious and slow. With my apparatus above described, an accuracy within one-tenth of a degree was readily and constantly obtained, both with a one inch and a one-eighth inch immersion objective. It will suffice to present, out of a large number of unusually good results on a fluid cavity of 0.54 mm diameter,

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*H. C. Sorby and P. J. Butler, *Proc. Roy. Soc.*, London, 1869, **17**, 297.

those obtained by means of the Fuess apparatus (*F*), the one most commonly used, and others by means of my own (*J*), the temperature being noted both of the disappearance (*d*) and re-appearance (*r*) of the bubble. The objective used was a one inch of Wm. Wales, with a working distance of 13 mms in the air, and 15 mms over a stratum of water 7 mms deep.

	F.	*J.*		
d	26.7	26.5	26.5	26.5
r	26.4	26.3	26.4	26.4

In place of the blowing tube a little agitator or churn at the end of the box had been previously tried, to produce the intermixture of the contents of the bath, but was given up on account of the inconvenient vibration and frequent dislodgement of the slide.

The apparatus, as thus constructed, I have long used, and may be found the most convenient warm stage when high temperatures are required; but another still more simple, lately devised, will best serve for the determination of carbon dioxide, and consists of the following parts :

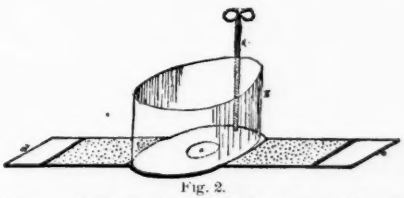


Fig. 2.

First. A shallow glass tank with thin and well annealed sides, of size sufficient to enclose the slide upon which the thin section is mounted. For this purpose I use a small chemical beaker *B*, with the thinnest bottom, and with its upper portion cut off, forming a thin round glass tank, about 6 centimeters in diameter and 3 cms deep.

Secondly. A plate of copper or brass like that used in Schultze's apparatus, or more simply one of the form represented in the figure, *d e*. Its dimensions, proportioned to those of the beaker-tank and of the stage of a large microscope, are as follows ; length, 23 cms; diameter at center, 6.5 cms; width of arms, 3.5 cms; central aperture, 2.5 cms ; height of wire support, 13 cms ; thickness of plate, 1 mm Each arm is wrapped in pasteboard, to prevent radiation, to the extent indicated by the shaded portion.

Thirdly. A delicate thermometer (made by Henry Green, of New York), with a small short bulb bent at right angles to the stem, and a very fine column, to obtain sufficient sensitiveness to minute varia-

tions of temperature, and complete immersion of the bulb in the small volume of liquid employed in the bath. The scale need not exceed in range from about 20° to 32° C., the thermometer being of such length that, when in position, the scale from 27° to 30° C. may be on the level of the eye-piece of the microscope, and readily visible without motion of the head. Each degree of the column should be about a cm in length and subdivided to tenths. The instrument used was standardized, and had a plus error of about 0°.05 at the portion of the scale employed.

Lastly. A pointed glass tube, with flexible rubber connection for blowing, and a wire support, *s*, to receive both this and the thermometer, attached to the metal plate.

The latter is laid upon the stage of the microscope, separated by thin plates of cork or a perforated piece of pasteboard; the tank, supplied with about 40 c.c. of water, is placed over the central aperture, *a*, and a taper beneath an extremity of one arm of the plate, and the apparatus is then ready for use in the way already described; the water of the tank being heated by conduction through the metal plate. The section of the mineral is best mounted upon a very thin slide, 45x26 mms, and this is guarded as before by rubber bands and held down by one or two little brass weights. Only a single taper is necessary for the low temperature required in the examination of carbon dioxide cavities, and even with this, a temperature of 43° C. may be obtained in the bath within a few minutes. The disappearance of the bubble may be completed in less than five minutes, the taper being removed as soon as the rising column approaches within 2 or 3 degrees of the critical point, roughly determined by a previous trial. If two tapers are used, the temperature of the water may be raised to 55° in about 20 minutes, or even much higher by the use of Bunsen gas burners. In summer the temperature of the atmosphere alone may be sufficient, especially if assisted merely by the current of warm breath, to obliterate the gas bubble. Its return may be readily caused, in a warm atmosphere, by adding from time to time a few drops of cool water to the bath, while the eye remains at the eye-piece, and a steady current of air is blown through the glass tube. Mounted slides used for such experiments must be labelled by writing with a diamond, or the paper label may be rendered waterproof by being coated successively with weak size and any transparent varnish, such as copal or shellac. To ascertain the limits of accuracy, the following determinations were made of the temperatures of disappearance (*d*) and re-appearance (*r*) of the bubbles in two cavities,

A and *B*, of the same thin section, with a variety of objectives, on two stands made by Fuess, of Berlin, and Powell & Lealand, of London, the objective being usually immersed in water, but sometimes not immersed. For comparison, the experiments of Vogelsang were exactly repeated with this apparatus, using two objectives of the same kind immersed in glycerine.

Objective.	Cavity A.			Cavity B.		
	d	*r*	Mean.	*d*	*r*	Mean.
Hartnack, No. 2	28.30	28.00	28.15	27.60	27.50	27.55
" " 4	28.40	28.20	28.30	27.60	27.70	27.65
" " 4, in glyc.	28.32	....	28.32	27.95	....	27.95
" " 7	28.40	28.10	28.25	27.85	27.80	27.82
" " 7, in glyc.	28.28	....	28.28	27.80	....	27.80
" " 9	28.35	28.32	28.33	27.80	27.60	27.70
W. Wales, 3 inch, not imm.	28.40	28.35	28.37	27.97	27.92	27.94
" " 1 "	28.40	28.35	28.37	27.96	27.92	27.94
" " 1 " not imm.	28.39	28.38	28.39	27.65	27.80	27.72
" " $\frac{2}{3}$ "	28.35	28.37	28.36	27.96	27.96	27.96
" " $\frac{4}{10}$ "	28.10	27.90	28.00	27.80	27.82	27.81
Pow. & Leal., $\frac{1}{3}$ " imm.	28.35	28.36	28.36	27.72	27.70	27.71
Average	....	....	28.33	....	....	27.79

From these experiments it may be inferred that with this apparatus, which may be called the immersion warm bath, it matters little for most purposes what liquid, stand or objective is employed; that water is preferable to glycerine from its greater mobility, convenience, and lack of cost, but its bulk is immaterial, so long as the bulb of the thermometer is covered; that it is decidedly advantageous to immerse the anterior lens of every objective in the bath, to avoid the annoying interference with observation produced by the vibration of the surface, and by the necessity for repeated re-focussing, when the objective is above the surface of the liquid; that careful determinations on minute cavities, with high powers, carried on slowly to enable the preparation, objective and thermometer to assume the same temperature, may be as accurate as any others; and that there is no difficulty in obtaining satisfactorily the two determinations within ten minutes to an approximation of about one-twentieth of a degree. The influence upon the temperature of the disappearance of the bubble exerted by forced dilatation,* producing adherence to the side of the cavity, appears to be very small, never exceeding a few hundredths of a degree, probably because the walls of these cavities

* Berthelot, *Ann. Chim.*, (3,) **30**, 232.

are not dry, but always lined by at least an imperceptible film of another liquid, the brine or saline solution.

The descriptions of this method, and of these forms of apparatus, have been given in the more detail, inasmuch as they may be of service in many other branches of thermal microscopy where the exact determination of the temperature applied is desirable, *e. g.*, as suggested by my friend, Mr. Arthur H. Elliott, in the determination of the melting point of rare chemical substances, etc. For this purpose, the apparatus in Fig. 1 might be supplied with another tube, on the opposite side to those represented, through which might be inserted, beneath the objective, a small glass tube, containing the substance to be examined, and thus immersed, by the side of the thermometer bulb, in the water, oil, paraffine, or other liquid which the circumstances may require for the bath.

The liquid inclusions in the white topaz of Rio Belmonte, Brazil, have been already the subject of considerable investigation by Brewster, and others; but the recent study of a large number of cleavage slices from fifty pebbles of this mineral, labelled "Minas Geraes, Brazil," peculiarly rich in fluid cavities, has presented several facts of some interest which have not been recorded by these observers.

Although it can hardly be claimed that the mysterious spontaneous motion which very commonly affects the gas bubbles in the most minute microscopic cavities, usually but a few thousands of a mm in diameter, has yet received a complete and perfectly satisfactory explanation, there can be little doubt that its essential dependence upon slight changes of temperature* has been sufficiently demonstrated. This view is confirmed by the fact that in a cavity 0.03 mm in length, in one of my slices of the topaz, the bubble, quiescent at ordinary temperatures, passes into active motion when the temperature is slightly raised, so that observation of this spontaneous motion becomes possible—a unique instance so far as I am aware—with a magnifying power of only 65 diameters. Several other like instances have been noted in these slices.

It is well known that the fluid cavities of most minerals lie to a large extent in planes, and that those of rounded symmetrical form predominate. Beautiful crystalline forms—in quartz, inverted crystals—often occur, and Brewster and Vogelsang have pointed out their occasional presence in topazes, exhibiting the contour of "negative rhombic tables and distorted octahedra." In a few choice slices of

* G. W. Hawes, *Am. Journ. Sci., loc. cit.*

my specimens of topaz, however, many extremely angular, elongated, branching and even reticulated forms of considerable size and novelty abound. Their outline is at many points decidedly crystalline, with

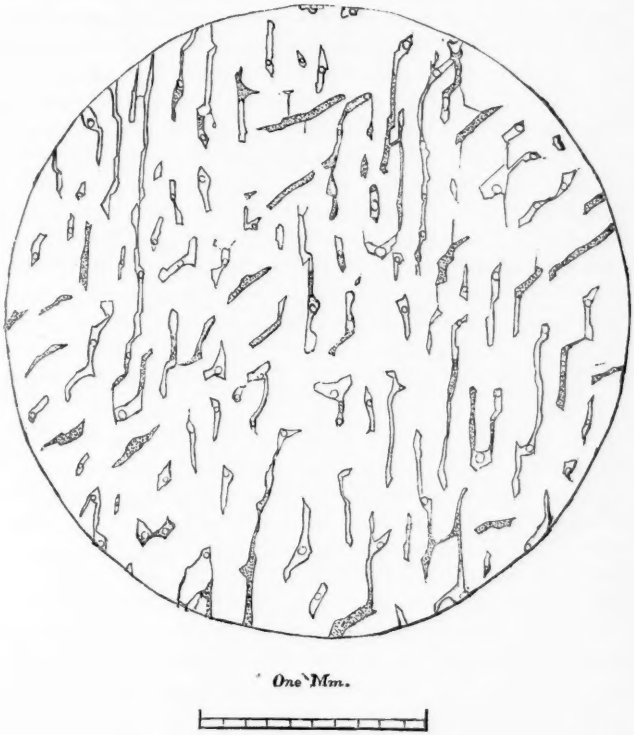


Fig. 3.

arms projecting at an angle of about 135°. As the preparation in which those figures occur, is a natural cleavage slice on the basal plane, this disposition of the cavities seems to have been guided by a parallelism to prismatic faces—it may be, on the planes $i-\breve{i} \wedge i-\breve{2} = 136° 35\frac{1}{2}'$. If so, the generalization of Brewster may have been pressed too far, that the cavities were generally "capriciously distributed, when the substance of the crystal was in a soft or plastic state." There is also a curious partial division of the two liquids, in regard to distribution in the cavities, the limpid and colorless carbon

dioxide, generally including a bubble, being mainly concentrated in the longer tubes, vertical in the figure, with a little brine at their extremities, while the thick and dark saline solution is mainly confined to the arms which project at the angle stated, and fills completely, always without bubbles, those which are straight, short, and lie entirely in that direction. This may indicate the result of molecular pressure in two directions, differing greatly in degree upon two liquids of widely differing density, the lightest and most mobile having been squeezed into the plane of least pressure. In general, the larger expansions of the cavities are mostly occupied by brine, while their attenuated extremities and fine tubular connections are filled by liquid carbon dioxide, occasionally including a bubble due to contraction.

The intricate connection of adjoining tubes may even produce cavities of unusual length, so that one containing both brine and

Fig. 4.

carbon dioxide, is 2.28 mms in length. The largest cavities noted by Brewster contained only the dense liquid; the largest observed by Vogelsang in topaz reached only 0.5 mm in one direction. Brewster however found in sapphire a cavity one-third inch in length, two-thirds full of a liquid expanding at 28° C. Fine capillary tubes project from many angles of these cavities, often directly toward each other in exact line from adjacent cavities, hinting at a broken connection. Such a relation seems to be indicated by the tubules between the main cavity in Fig. 4, and the shorter one in the lower right-hand part of that figure. The abundance and direction of these tubules plainly show that at the original conditions of temperature during the formation of the topaz crystal, parts of its mass were filled by anastomosing canals occupied by the two fluids, which have been mostly shut up by compression during the ensuing contraction of the mass. That these still remain as imperceptible fissures, was shown by one of Brewster's observations: on heating a small cavity, the liquid was forced along into the apparently compact topaz, through a latent fissure which opened to receive it as it advanced, and then closed up behind it.

The connection or coalescence of straight adjoining cavities at one extremity, frequently results in U-shaped or hook-shaped forms. If

expansions occur at or near the upper ends of the U or hook, and these are occupied by large bubbles of the gas, their contents are naturally in a state of unstable equilibrium, readily subject to movement by changes of temperature in the topaz matrix. This explains the partial transference of contents I have occasionally observed in U-shaped cavities of this kind, portions of the liquid carbon dioxide, or minute bubbles of the gas passing along an arm from one expansion to the other, as in a naturally formed differential thermometer.

In one slice of the topaz the temperature of the disappearance of the gas bubbles was determined on ten cavities, chosen at random, at the following points : 26.6, 27.1, 27.1, 27.1, 27.3, 27.6, 27.6, 27.6, 27.7, 27.8. Though these cavities varied greatly in size, the figures are seen to be very close—within a degree—the gas bubble in the first one noted being proportionately of unusually large size. Several instances of this kind observed incline me to suspect that the wide divergence in the results obtained from cavities in the same slice of rock or mineral, reported by other observers, may have been due, in some cases at least, to the coarse and inexact methods and apparatus hitherto in use.

THE AMERICAN CHEMICAL SOCIETY.

XVI.—Proceedings.

Regular meeting, June 3d, 1881.

The meeting was called to order at 8:30 P.M., Dr. A. R. Leeds in the chair.

Minutes of previous meeting were read and, after corrections, were approved.

There was no report from the Board of Directors.

The committee appointed to fill the vacancy in the Committee on Papers and Publications, reported that they had selected Dr. Endemann for the position. This recommendation being put to the Society, it was carried unanimously.

The committee appointed to take steps for the drawing up of an obituary notice of Dr. Goldmark, reported that Dr. O. H. Krause had been asked to undertake that duty.

The committee appointed to inquire into the question of filling the vacancy in the Board of Directors, caused by Dr. Goldmark's death, from a legal point of view had no report at present.

The resignation of Mr. Wm. Wheatley was then read, and accepted.

Mr. A. P. Hallock was then balloted for and duly elected a member of the Society.

After which the following paper was read.

"On the Analysis of Elephants' Milk." By Dr. Chas. A. Doremus.

In discussing this paper, Dr. Leeds remarked that the ash closely approximated to that of human milk. He also said, commenting on the difficulty mentioned by Dr. Doremus in evaporating the milk, that 10 c.c. of milk upon 30 c.c. of ignited sand worked very well, causing no charring; by employing a large excess of sand the milk does not touch the sides of the dish.

Dr. E. R. Squibb then took the chair, and the following paper was read:

"On the Adulteration of Food, Drink and Drugs, from the Chemist's Standpoint, and on the Attitude of Chemists in the matter of the Appointment of Government Analysts." By Dr. A. R. Leeds.

Mr. ELLIOTT asked Dr. LEEDS if he knew the composition of the material insoluble in water, which he had found in condensed milk, and Dr. LEEDS replied that he had not yet completed the analysis. To a further inquiry of Mr. ELLIOTT, Dr. LEEDS remarked that he had not made any tests for gelatine in condensed milk.

Dr. DOREMUS remarked that one of the first things to decide in this question of adulteration is, "What is adulteration?" and discussed at some length the matter of alum baking powder, claiming that at the present time there is no proof that they are unwholesome.

Dr. E. R. SQUIBB remarked that he looked upon the matter from a different standpoint than most chemists, and would punish as a fraud anything that was sold and not found as represented. He condemned in strong terms the sale of quack medicines, and remarked that the American people take from five to six times as much medicine, *per capita*, as any other nation.

Mr. EIMER also made some remarks upon the enormous quantities of patent medicines sold in the United States.

On motion, the meeting was adjourned.

ARTHUR H. ELLIOTT,
Recording Secretary, pro tem.

XVII.—On the Composition of Elephants' Milk.

By Charles A. Doremus, M.D., Ph.D.

(Read before the American Chemical Society June 3d, 1881.)

Noticing the recent advertisement in this City regarding the "baby elephant," it occurred to me that perhaps no analysis of the milk of this species of the mammalia had been recorded. This I found corroborated, for though the milk of many animals had been subjected to analysis, no opportunity had ever presented itself to obtain elephants' milk.

Through the courtesy of Mr. Jas. A. Bailey, I was enabled to procure samples of the milk on several occasions.

On March 10th, 1880, the elephant Hebe gave birth to the female calf America. Hebe is now twenty-eight years old, and the father of the calf, Mandrie, thirty-two. Since the birth of the "baby," the mother has been in excellent health except during about ten days, when she suffered from a slight indisposition which soon left her.

When borne the calf weighed 213½ pounds, and in April, 1881, weighed 900 pounds, a very fair year's growth on a milk diet. At the time I procured the samples, both mother and calf were in fine health.

To obtain the milk was a matter of some difficulty. The calf was constantly sucking; nursing two or three times an hour, morning, noon, and night. The milk could be drawn from either of the two teats, but only in small quantities. The mother gave the fluid freely enough apparently to her infant, but sparingly to inquisitive man, so the ruse had to be resorted to of milking one teat while the calf was at the other.

When I first examined the specimens they seemed watery, but, to my surprise, on allowing the milk to stand, I could not help wondering at the large percentage of cream.

The following represents approximately the daily diet of the mother: 3 pecks of oats, 1 bucket bran mash, 5 or 6 loaves of bread, ½ bushel of roots (potatoes, etc.), 50 to 75 pounds of hay, and 40 gallons of water.

Elephants eat continually, little at a time, to be sure, but constantly picking. This habit is also observable in the way the calf nurses. The first specimen of milk was procured on the morning of April 5th, the second on the 9th, and the 3d on the 10th.

The last exceeded the others in quantity, and would therefore be the fairest of the three. It took several milkings to get even these, for the calf would begin to nurse, then stop, and when she stopped, the flow of milk did also.

I was assured by Mr. Cross and the keeper, Mr. Copeland, that the milk I obtained had all the appearances of that drawn at various times since the birth of the calf. Mr. Cross, when in Boston, compared the milk with that from an Alderny cow, and found the volume of cream greater.

I endeavored to have the calf kept away from the mother for some hours, but could not, since she is allowed her freedom, worries under restraint, and besides has never been taken from the mother. The calf picked at oats and hay, but was dependent on the mother for nourishment.

It would have been a matter of great satisfaction to me had I been able to obtain a larger quantity of the milk, or to have gained even an approximate knowledge of the daily yield, but was obliged to content myself with what I could get. By comparing several samples, however, a just conclusion regarding the quality was found.

The analyses of the samples gave the following results:

	I. April 5th. MORNING.	II. April 9th. NOON.	III. April 10th. MORNING.
Quantity	19 c.c.	36 c.c.	72 c.c.
Cream	52.4 vol. %	58	62
Reaction	Neutral.	Slightly alkaline.	Slightly acid.
Sp. gr	....	....	1023.7
In 100 parts by weight :			
Water	67.567	69.286	66.697
Solids	32.433	30.714	33.303
Fat	17.546	19.095	22.070
Solids not fat	14.887	11.619	11.233
Casein	14.236	3.694	3.212
Sugar		7.267	7.392
Ash	0.651	0.658	0.629

Ten grams were taken for analysis, and in No. III duplicates were made. It is evident from these analyses that the milk approaches the composition of cream, yet it did not have the consistency of ordinary cream. A cream even raised upon it. Under the microscope the globules presented a very perfect outline, and were beautifully even in size and very transparent. The cream rose quickly, leaving a layer of bluish tinge below. The milk was pleasant in flavor and odor, and very superior in these respects to that of many animals, such as goats or camels, and quality equal to that of cows. Nor did the milk emit any rank odor on heating.

When 10 grams were evaporated to dryness, the last portions of water were hard to remove, as the residue fairly covered with oil. Only by long continued application of heat, and in analysis III, over sulphuric acid in vacuo, could a constant weight be obtained. I would have used sand in the drying or Baumhauer's method of fat extraction, but for the small quantity of milk at my disposal, and from fear of loss of fat in the latter case.

The fat in III was determined by extracting the dried residue, and also with 20 c.c. of milk, by adding alkali and shaking with ether, removing and evaporating the ether, and weighing the fat.

As is shown in the table, the sp. gr. is very low, though the solids, and solids not fat, are great. The ash, casein and sugar are in about the usual proportion. The weight of casein is, it is true, but half that of the sugar. The milk indeed shows an unusually great preponderance of the non-nitrogenized elements, and this seems to correspond with the wants of the animal, since the fatty tissues are

greatly developed in elephants. According to Mr. Cross, who has had large experience with these animals, they are fatter in the wild state than in bondage. These specimens must appear as exceptional; they may be considered by some as "strippings," but as against such a view we have the recurrence in each sample of the same characteristics in the milk, and a near correspondence in the composition. As may be seen from the subjoined analyses given by v. Gomp-Besauer, the milk belongs to the class of which human and mare's milk are members, especially as regards the proportion of the non-nitrogenized to the nitrogenized elements. It may be remarked that though approaching the composition of cream, it still differs enough to require it to be considered milk.

Perhaps if a larger quantity of the milk could be collected, it would assume a more watery character, and approximate more nearly to other milk in that respect. However this may be, the quality of the fat deserves some attention.

The fat has a light yellow color, resembling olive oil, is very pleasant in odor and taste, is liquid at common temperatures, but solidifies at 18° C. = 64° F.

The cow must yield a considerable quantity of milk since the growth of the calf has been constant, and at the time these samples were milked, the mother gave as freely to her babe as she ever had since its birth. The calf having gained 7–800 lbs. on a milk diet in one year, it is presumable that it had no lack of nourishment.

In size the "baby" compared equally with other elephants in the same menagerie, who were known to be four and five years old.

From whatever standpoint, therefore, we view the lacteal product of these four-footed giants, we are fully warranted in ascribing to it not only extreme richness, but also great delicacy of flavor.

	Women.	Cows.	Goats.	Ewes.	Asses.	Mares.	Buffalo Cows.	Camels.	Sows.	Hippopotamus.	Elephants.
Water	86.271	84.28	86.85	83.30	89.01	90.45	80.640	86.34	81.80	90.43	66.697
Solids.....	13.729	15.72	13.52	16.60	10.99	9.55	19.360	13.66	18.20	9.57	33.303
Fat	5.370	6.47	4.34	6.05	1.85	1.31	8.450	2.90	6.00	4.51	22.070
Casein	2.950	3.57	2.53	5.73	3.57	2.53	4.247	3.67	5.30	4.40	3.212
Albumen.....		0.78	1.26							Milk Sugar included.	
Milk Sugar.....	5.136	4.34	3.78	3.96	5.05	5.42	4.518	5.78	6.07		7.392
Ash.....	0.223	0.63	0.65	0.68		0.29	0.845	0.66	0.83	0.11	0.629
Nitrogenized....	2.950	4.35	3.79	5.73	3.57	2.53	4.247	3.67	5.30		3.212
Non-Nitrog'niz'd	10.506	10.81	8.12	10.01	6.90	6.73	12.968	8.68	12.07		29.462

XVIII.—Upon the Adulteration of Food, Drink and Drugs, from the Chemist's Standpoint; and upon the Attidude of Chemists in the Matter of Appointment of "Government Analysts."

By Albert R. Leeds.

Abstract.

The subject of adulteration had not received that amount of attention from the chemists which its nature and amount, as at present practiced in the United States, properly demanded. And in neglecting to assume control of the investigation of the subject, and of the information and education of the public mind as to the actual facts, they had left the field in the possession of scientific demagogues and pseudo chemists who, for the past four years, had been sending out through the daily press an unlimited amount of sensational literature, either in part or altogether false. The investigations as to the facts had been mainly fragmentary and sporadic in their character, instituted from time to time by various Boards of Health, but without much outcome in the arrest and prosecution of offenders. But this period of education had now gone by, and the time had come when the various States were about to pass laws upon adulteration. Some laws had been already enacted, and grave blunders had been committed. The experience in England had shown how difficult it was to secure wise and efficient legislation, and it was very important for chemists in America to avail themselves of that experience, and to control and shape the laws now under consideration in the legislatures of the various States. Moreover, the duty of the public analyst required public training and accurate knowledge of certain topics not ordinarily studied by chemists. Finally, the analysts could not properly perform their labors without the aid of suitably qualified inspectors, and as yet these two professions did not exist in the country and would have to be in a sense created.

Dr. Leeds, who had been commissioned by the State of New Jersey to investigate the facts concerning adulteration, as a basis for future State legislation, then gave a brief resumé of the results of his labors up to date. He had analysed a very large number of samples, and without claiming that the facts were universally true for the whole country, yet the examinations of so many articles of each kind, purchased at random from dealers in various parts of New Jersey and in the City of New York, might justly be regarded as representing a reasonably close approximation to the true facts in the case.

In regard to teas, three classes of adulterated samples had been found. The smallest class contained an amount of mineral matter in excess of that which should be present from facing materials alone, or from impurities which could properly be derived from the processes of preparation for the market. The largest class consisted of teas adulterated with exhausted leaves. Finally, in some samples foreign leaves were present in such numbers as to denote intentional adulteration. But the percentage of adulterated teas was much smaller than was anticipated (10 per cent.), a majority of the teas being of inferior grade, their prices ranging from thirty to fifty cents per pound. Nearly all the coffees examined, both whole and ground, were pure; the adulterant in the other cases being chiccory. The essences of coffee sometimes contained scarcely any coffee—one sample was composed almost entirely of chiccory, caramel and liquorice.

The manufacture of mixed sugars, containing both cane sugar and glucose, is now largely carried on in the United States, the product being sold under the name of "new process" sugar by the manufacturers. This fact had given rise to a popular belief that almost all varieties of sugar were more or less adulterated. Such was not found to be the case, most of the white sugars, purchased at random, being found pure; and of the brown sugars, which were the more adulterated, certain samples furnished by dealers as in their belief adulterated, were found to contain no more inverted sugar than might properly be present in a sugar of a low grade. A similar remark applies to the sirups. Even the lowest priced sirups were found, with few exceptions, to contain no more glucose than was to be expected in a non-adulterated article. No free sulphuric acid, or excess of lime, was present in any case.

The specimens of flour examined were uniformly pure, no other meal or alum being found in any instance. In bread, however, sufficient samples showing the employment of alum were obtained to demonstrate its occasional use by bakers. Cream of tartar was found to be extensively adulterated, the adulterants being sulphate of lime, acid phosphate of lime and starch. The first-named substance was likewise present in some samples of bicarbonate of soda.

Some of the manufacturers of the baking powders now so extensively sold, use only bicarbonate of soda, cream of tartar and starch. Others employ either partly or altogether, in the place of the cream of tartar, alum or acid phosphate of lime, or a mixture of these two salts. Of the condiments and spices very few were pure, though in no instance was any injurious metallic adulterant detected.

Many of the samples of vinegar contained a much lower percentage of acetic acid than should have been present, but in no case were mineral acids present, and in only one instance a metallic substance—lead in traces. Some of the so-called white wine vinegars had all the characters of ordinary cider vinegar, decolorised by filtration through animal charcoal. None of the green pickles examined were free from copper—one pickle containing 15 milligrams—although the pickles prepared by the use of brine, and those imported, with the Crosse & Blackwell label, were found unexceptionable. The employment of tin cans in the preservation of vegetables is reprehensible, both tin and lead being present in the canned tomatoes examined. The skimming and watering of milk was still very extensively practiced in New York and New Jersey, although stringent laws had been passed for its repression.

Condensed milk varied remarkably in composition, the percentage of water ranging from 25.5 to 59 per cent., and of fat from 3 to 11 per cent.

THE AMERICAN CHEMICAL SOCIETY.

Reports on American and Foreign Patents Relating to Chemistry.

American Patents.

Condensed from the Official Gazette of the **U. S. Patent Office**, by ARNO BEHR.

Jan. 4, 1881.

236,150.—*Lubricating compound.* PATRICK H. FITCH.

Soap, sal-soda, carbonate of ammonia, sal-ammoniac, red lead, naphtha and water.

236,198.—*Method of waterproofing textile fabrics, leather, etc.* PETER H. VAN DER WEYDE.

The objects to be waterproofed are placed in a closed box and subjected to the vapors evolved by heating ozokerite to 400 or 500° F.

236,216.—*Marine paint.* ROBERT H. DIMOCK.

Linseed oil, suboxide of copper and carbolic acid.

236,240.—*Treating caoutchouc.* GEORGE M. MOWBRAY.

Caoutchouc combined with naphthalene.

236,280.—*Composition for tanning hides and skins.* HEINRICH TRENK.

Two watery solutions are used, the first of pyroligneous acid and chromate of alumina, the second of crude tartar and chloride of zinc.

236,248.—*Vegetable soup compound.* JOHN D. WARREN.

Vegetables cut and dried, and mixed with salicylic acid and sulphate of soda.

236,299.—*Process of, and apparatus for, evaporating saccharine liquids.* GEORGE B. BOOMER.

236,330.—*Process for the manufacture of glucose.* RUDOLPH D' HEUREUSE.

Refers to a mechanical treatment of the steeped corn, preliminary to the manufacture of the starchy portion into starch or glucose, which treatment has for its object the separation of the hulls and germs, and the removal of the soluble gluten.

The successive use of oxalic acid and soda for the removal of lime from the converted product, is also claimed.

Jan. 11, 1881.

236,471.—*Ice-making machine.* FRANZ WINDHAUSEN.

236,480.—*Compound for manufacture of gas tubing.* SAMUEL BARR.

A composition of glue, glycerine, soap, borax, and a solution of sulphate of iron, to be applied between the two textile coverings of the tubing.

236,483.—*Substitute for butter.* OTTO BOYSEN.

A mixture of oleomargarine and an alkaline solution is agitated until partial saponification is effected, and then a minute quantity of butyric acid is added.

236,506.—*Compound filling for fireproof structures, such as safes, chests, bank vaults and doors.* WILLIS B. MARVIN.

Essentially a mixture of anhydrous sulphate of lime and fibrous asbestos.

236,521.—*Preserving compound.* JEAN WICKERSHEIMER.

A mixture of salicylic acid, methylic alcohol, glycerine, and a solution of alum, common salt and potash, for the preservation of meat intended for food.

236,559.—*Tanning Hides.* ROBERT F. and ISAAC DOBSON.

After immersion for several days in a bath of strong brine and tanning extract, the hides are subjected to the action of gaseous sulphurous acid.

236,598.—*Preserving eggs.* CHARLES H. KIRKHAM.

The substance of the egg is, before desiccation, mixed with a small proportion of starch paste.

236,600.—*Process of, and apparatus for, treating animal matter.* ALFRED and EDWIN LISTER.

Refers to the drying of the animal matter.

Jan. 18, 1881.

236,709.—*Composition for treating rubber cloth.* PHILIPP KROPP.

Linseed oil, oxide of manganese, copal and coloring matter.

236,714.—*Manufacture of explosive compounds.* CHARLES A. MORSE.

The explosive consists of nitroglycerine, a resinous substance, and nitre intimately mixed.

236,739.—*Process of, and apparatus for, treatment of ores.* THOMAS G. WALKER.

The process consists in blowing powdered ore, together with air, through heated pipes, by means of a steam jet.

236,763.—*Process of manufacturing artificial manure.* FRANCIS J. BOLTON and JAMES A. WANKLYN.

Urine is evaporated to dryness in contact with small proportion of charcoal, or a similar material.

236,764.—*Apparatus for making vinegar.* OSCAR F. BOOMER and HENRY R. RANDALL.

236,778 and 236,779.—*Process of desulphurising and devulcanising waste vulcanised india rubber.* HENRY A. CLARK.

These processes seem to consist in a treatment with vapor of turpentine.

236,843.—*Artificial production of ice and cold.* AUGUSTE J. ROSSI and LEONARD F. BECKWITH.

The liquid consists of a solution of ammonia gas in glycerine.

Jan. 25, 1881.

236,878.—*Apparatus for purifying salt.* JOHN H. DUNCAN.

236,940.—*Apparatus for evaporating solutions in contact with air or other gas.* JULES L. FAESCH.

236,995.—*Bituminous cement.* EDWARD J. DE SMEDT.

Heats coal-tar with an oxidizing agent.

237,007.—*Tanning compound.* JAMES FOLEY.

An ordinary tanning solution mixed with the extract of the wood of Morus tinctoria.

237,017.—*Paint.* JOHN F. HOFFMANN.

Impure carbolic acid mixed with lime, rosin, and asphaltum.

Feb. 1, 1881.

237,113.—*Apparatus for recovering soda from waste alkaline liquor.* SAMUEL LEE.

237,134.—*Filtering apparatus.* CHARLES H. SENFF and PAUL CASAMAJOR.

A sheet of filtering material is rolled in a number of layers around a perforated drum, in the interior of which a partial vacuum is created. The whole is immersed in the liquor to be filtered. By turning the drum, and withdrawing the cloth, the filtering surface is continually renewed as long as the cloth lasts.

237,217.—*Process of extracting gold and silver from their ores.* CHARLES DE VAURIAL.

237,249.—*Treatment of vulcanised india rubber and gutta-percha.* HENRY A. CLARK.

Claim: The combination with desulphurized india rubber of a vegetable oil or a resinous substance.

237,252.—*Compound for making and treating steel.* JOHN CONANT.

Sulphate of copper, rosin and sal ammonia.

Feb. 8, 1881.

237,484.—*Process of refining vaseline.* ROBERT A. CHESEBOROUGH.

It is kept just at the point of vaporisation in an open vessel until the smelling portions are driven off, and afterwards filtered through bone-black.

237,497.—*Method of making articles from waste amber.* ABBOT R. DAVIS.

The method consists in treating the pieces with solvents and subjecting them to pressure.

237,630.—*Process of preparing hides for tanning.* JAMES S. SWAN.

Subjecting the limed hides to the action of an aqueous solution of alum.

Feb. 15, 1881.

237,816.—*Purifying sulphate of alumina.* WILLIAM, THOMAS and JAMES CHADWICK, and JOSIAH W. KYNASTON.

Iron is precipitated with ferrocyanide of calcium, and arsenic dissolved in a sulphide, the latter precipitate carrying down the former.

237,830.—*Galvanic battery.* A. FLOYD DELAFIELD.

237,835.—*Purification of syrups and molasses in the manufacture of sugar from beet-root and cane.* AUGUSTE P. DUBRUNFAUT.

To the liquids to be subjected to the process of osmose, a certain amount of lime is added. When the action of osmose is finished, the lime is removed with carbonic acid.

237,878.—*Fuel.* GEORGE KELLY.

Coal-dust ground with lime, and formed, while in a wet state, into masses of convenient size and shape.

237,905.—*Process of preserving meats.* JOHN L. REESE.

Packing the meat in melted fat charged with sulphurous acid.

237,917 and 237,918.—*Production of oxychinoline.* ZDENKO H. SKRAUP.

It is produced by the action of glycerine and sulphuric acid upon a mixture, either of orthonitrophenol and orthoamidophenol, or of paranitrophenol and paramidophenol.

Feb. 22, 1881.

238,133.—*Manufacture of fertilizers.* GEO. T. LEWIS.

Exposes a mixture of an insoluble phosphate and pyrites to the action of atmospheric oxygen and moisture.

March 1, 1881.

238,240.—*Fertilizers.* JOSEPH M. and JOHN LIPPINCOTT.

The slag produced in the manufacture of pig iron is proposed as an ingredient of a fertilizer.

238,277.—*Process of obtaining the perfumes of natural flowers by absorption.* ROBERT A. CHESEBOROUGH.

The flowers are steeped in vaseline; the latter taking up the essential oils is transformed into a perfume.

238,389.—*Manufacture of leather.* CHRISTIAN HEINZERLING.

Treating the hides with chromic acid, and afterwards with a solution of stearine.

238,474.—*Treatment of starch and starchy substances, and the production therefrom of a compound body capable of being used as a substitute for malt in brewing, and for other purposes.* CORNELIUS O'SULLIVAN and WILLIAM G. VALENTIN.

Conversion of starch with sulphuric acid, until the dry substance has a specific rotation of 171, and Fehling's solution indicates 44 per cent. of grape sugar in the dry substance.

March 8, 1881.

238,509.—*Process for sugar refining, and apparatus for carrying on the same.* S. MORRIS LITTLE.

Uses the sirups separated from high grade sugars for liquoring or washing low grade sugars in a centrifugal machine.

238,570.—*Baking powder.* CHARLES A. CATLIN.

Sulphate of ammonia and bicarbonate of soda.

238,613.—*Manufacture of aluminous cake.* CONRAD SEMPER.

Reduces the iron to the ferrous salt by addition of oxalic acid.

238,680.—*White zinc pigment, and mode of manufacturing the same.* THOMAS GRIFFITHS.

The precipitated mixture of sulphide of zinc and sulphate of barium is mixed with common salt and heated to a bright red heat, and the salt is afterward dissolved out.

March 15, 1881.

238,867.—*Petroleum illuminating oil.* HENRY V. P. DRAPER.

Petroleum mixed with a small proportion of chloroform.

238,916.—*Explosive compound.* FREDERICK C. KEIL.

Nitroglucose, nitrate and chlorate of potash, and prepared vegetable fiber.

238,980.—*Manufacture of metallic compounds from sulphur and sulphides.* JOHN B. SPENCE.

March 22, 1881.

239,033.—*Preserving wood.* BRANDT V. B. DIXON and JOSEPH P. CARD.

Wood is impregnated with chloride of lead.

239,089.—*Manufacture of sulphate of alumina.* JOS. H. EASTWICK.

The claim is for decomposing a mixture of ground halloysite and hydrate of alumina with sulphuric acid.

239,242.—*Incrustation Preventative.* WILLIAM J. GILLESPIE.

Soda-ash, linseed oil cake, oak bark, copperas, potatoe starch and charcoal.

March 29, 1881.

239,346.—*Process of obtaining magnesia.* CARL SCHEIBLER.

Lime is removed from impure burned magnesia by dissolving it in a sugar solution.

239,394.—*Process of, and apparatus for, manufacturing phosphoric anhydride.* H. S. MAXIM.

Claims the bringing together of a jet of vapor of phosphorus, and a continuous blast of air of sufficient volume to oxidise all the phosphorus to phosphoric anhydride.

239,417.—*Incrustation preventative.* PASQUALE ALFIERI.

Carbonate of baryta, nitrate of ammonia, chloride of sodium, and vegetable charcoal.

239,423 to 239,425.—*Treating pyroxyline.* LEONARD S. BEALS.

The object of these patents is the production of a plastic compound containing pyroxyline, nitrobenzole, oil of lavender, benzole, alcohol, wax or paraffine.

April 5, 1881.

239,602.—*Baking powder.* CHARLES A. CATLIN.

An alkaline carbonate in combination with sulphate of magnesium.

239,618.—*Process of, and apparatus for, distilling petroleum products.* ALBERT NEILSON.

239,622.—*Art of separating animal fibers from vegetable fibers.* GEORGE B. and ALFRED L. RICE.

The fibers are mixed with bleaching powder, and heated in a close vessel.

239,642.—*Method of preparing anthracite waste for combustion.* ALFRED BERNEY.

The dust is mixed with lime, or soda, and asphalt, or tar, and water.

239,711.—*Manufacture of iron and steel.* ALFRED BRACONNIER.

Superheating the metal, introducing it into a converter, and forcing a current of reducing gas through the molten metal.

239,722.—*Process and apparatus for desiccating substances.* LYDIA J. CADWELL.

April 12, 1881.

239,974.—*Indelible ink.* AARON N. MOSES.

Caustic potash, seed-lac, permanganate of potash, and lamp-black.

240,094.—*Petroleum products, and process of obtaining and deodorising the same.* MARTIN CONNELLY.

Heavy petroleum oil is heated with unslaked lime.

240,126.—*Preserving butter.* JOHN HARGER.

A solution of boracic acid in glycerine, and of sulphate of potassium in water, is added either to the cream or butter.

240,196.—*Preparation of hydrochloric acid.* ERNEST SOLVAY.

A solution of chloride of calcium absorbs hydrochloric acid gas, and can be made to give it off again by heating.

April 19, 1881.

240,248.—*Process of, and apparatus for, concentrating sulphuric acid.* JUNIUS GRIDLEY.

240,359.—*Manufacture of artificial indigo.* ADOLF BAEYER and HEINRICH CARO.

Xanthate of sodium is used as a reducing agent in order to produce indigo from orthonitrophenylpropiolic acid.

240,360.—*Dyeing fabrics with artificial indigo-blue.* ADOLF BAEYER and HEINRICH CARO.

The reaction mentioned in the preceding patent is used to develop the color on the fiber.

240,361.—*Manufacture of artificial indigo.* ADOLF BAEYER.

The dye-stuff produced by the action of ferrous sulphate upon the sulpo-compound of orthonitrophenylpropiolic acid is treated with sulphurous acid, and then precipitated with common salt.

240,365.—*Apparatus for testing illuminating fluids.* ALEX. BERNSTEIN.

240,406.—*Filter press.* ALEXANDER GORDEN.

240,493.—*Process of tanning.* GANDENZIO DALLA ZONCA.

April 26, 1881.

240,597.—*Manufacture of aluminous cake.* GEORGE T. LEWIS and CARL V. PETRAEUS.

After the removal of the principal portion of the iron by precipitation with yellow prussiate of potash, the rest of the iron is reduced to the ferrous state by zinc.

240,651 and 240,652.—*Treatment of dextrine maltose, and apparatus therefor.* ALEXANDER LOW BRUCE, GEORGE STENHOUSE, WILLIAM MCCOWAN and ANDREW HADDOW.

A glucose sirup which the inventors call dextrine maltose, is in thin films brought to a state of dryness by means of specially constructed machines.

240,796.—*Process of, and apparatus for, manufacturing grape sugar.* HORACE WILLIAMS.

The well known practice of artificially cooling the concentrated sugar solution, and of introducing crystallised grape sugar into the mass in order to induce crystallisation, is claimed as new; also a tank provided with cooling pipes, and a stirrer in the shape of a screw.

Foreign Patents.

Condensed from R. BIEDERMANN'S Report to the German Chemical Society, by OTTO H. KRAUSE.

G. BORSCHE, Leopoldshall: *Method of obtaining potassium-magnesium sulphate from kainite.* (Germ. P., No. 10642, Nov. 4, 1879.)—Crude kainite is dissolved in water of 30–35° C., to a density of 1.25, and crystallized magnesium sulphate added, upon which potassium-magnesium sulphate crystallises out. The mother-liquor is concentrated by evaporation, and mixed with a hot solution of magnesium chloride, whereby nearly all the sodium chloride contained in the kainite is separated as a powder.

R. GRÜNEBERG, Altdamm: *Improved method of working up kainite.* (Germ. P., No. 10754, Dec. 18, 1879.)—Kainite is macerated with a solution of schoenite, saturated in the cold, whereby the kainite is converted into schoenite. Sodium and magnesium chloride enter into solution, and can be used to dissolve native or artificial carnallite.

F. JULLIEN, Lorient: *Manufacture of iodine from marine plants.* (Engl. P., No. 5041, Dec. 9, 1879.)—Marine plants or the varec are systematically extracted, and the lyes precipitated with iron or copper sulphate. The precipitate separated by decantation, is then distilled in retorts.

A. HEGENER, Cologne: *Improvements in apparatus for obtaining ammonia from gas liquors.* (Germ. P., No. 11669, March 11, 1880.)—Two tanks are placed one over the other, and over the gas liquor boiler. The upper one contains milk of lime and is open on top. The lower one is connected with the upper one and with the boiler, by means of cocks and pipes so arranged as to enable steam from the boiler to force the milk of lime received from the upper tank into the gas liquor.

I. P. KAGENBUSCH, Leeds: *Extraction of aluminium and gold from clay.* (Engl. P , No. 4811, Nov. 25, 1879.)—The inventor claims that from clay fused with the aid of fluxes and electrolisis, aluminium can be obtained by cupellation of the alloy of lead and aluminium. Gold is said to be obtained in a similar manner.

OTTO E. POHL, Liverpool: *Manufacture of sulphate.* (Engl. P., No. 5031, Dec. 9, 1879.)—Proposes to make sulphate by bringing sulphurous acid gas and heated air into contact with a solution of sodium chloride which is being evaporated.

AKTIENGESELLSCHAFT FARBWERKE, successors to Meister LUCIUS UND BRUENING, Hoechst, a. M.: *Method of oxidising leuco-bases and their sulphuric acids with the aid of chlorinated quinones.* (Germ. P., No. 11412, Nov. 11, 1879.)—The term leuco-bases is intended to comprise not only leucaniline and the corresponding bases, but also the bases resulting from the combination of aldehydes, or acid chlorides, with primary, secondary and tertiary aromatic monamines. The production of green dyes results chiefly from the oxidation of methylated, ethylated, phenylated and benzylated derivatives of diamidotriphenylmethane and its homologues. Diamidotriphenylmethane gives, by oxidation with chlorinated

quinones, a reddish-blue, not particularly fine, coloring matter. Methylated, ethylated, phenylated and benzylated derivatives of this base give, on the contrary, very fine dyes, some of which are directly soluble in water.

All the leuco-bases from the rosaniline-melt can, by means of chloranile, be converted into coloring matters in the same manner as the leuco-bases of triphenylmethane.

AKTIENGESELLSCHAFT FARBWERKE, successors to Meister LUCIUS UND BRUENING, Hoechst, a. M.: *Improvements in the preparation of coloring matters with the air of chlorinated quinones.* (Germ. P., No. 11811, Nov. 12, 1879; addition to Germ. P., No. 8251, June 24, 1879.)—By employing the various mono and dimethylated, mono and diethylated bases, dyes are obtained of different shades, from reddish-violet to bluish-violet, which are all soluble in water.

GEBRUEDER RAMDOHR, Wanzleben: *Manufacture of magnesia from magnesium chloride, by heating it to redness in the oxidising flame, and passing steam over it.* (Germ. P., No. 11540, Oct. 9, 1879.)—Relates to practical details of the process in which this well known reaction is employed.

H. GUENTHER, Berlin: *Improvements in the method of preparing black printing ink.* (Germ. P., No. 11930, May 8, 1880; addition to Germ. P., No. 9566, Oct. 28, 1879, see this JOURNAL, **2**, 231.)—Heavy tar oil from the manufacture of anthracene is boiled with 10 per cent. cupric chloride dissolved in water, whereby a saving of aniline voilet results.

M. WEINRICH, Vienna: *Treatment of sugar solutions.* (Engl. P., No. 4831, Nov. 26, 1879.)—To the heated beet sirup, calcium hydrate and milk of lime are added, to produce saccharate of lime.

E. MOURLOT, Paris: *Substitute for gutta-percha.* (Engl. P., No. 4846, Nov. 27, 1879.)—The tar which remains in the retort after the dry distillation of birch bark.

CHARLES TELLIER, Paris: *Treatment of coal.* (Engl. P., No. 4473, Nov. 3, 1879.)—The coal is separated from foreign matters by floating it off in a concentrated solution of calcium or magnesium chloride. (A process similar to the above was described by Hargreaves, *Dingler's Polyt. Journ.*, 1868. R. B.)

JAMES WEBSTER, Edgbaston: *Preparation of aluminium bronze.* (Germ. P., No. 11577, April 2, 1880.)—Aluminium is deposited electrolitically upon granular or sheet copper to the extent of 1 to 10 per cent., and then combined with 1 to 6 per cent. of an alloy composed of 20 pts. nickel, 20 pts. copper, 30 pts. tin and 7 pts. aluminium.

A. VON KERPELY, Chemnitz: *Method of preparing bricks from limestone or dolomite.* (Germ. P., No. 11348, Feb. 10, 1880.)—Burned limestone or dolomite is made into a paste with vinegar, and the resulting highly plastic mass formed into bricks, and calcined at a white heat.

JACOB OERTLE, Nuremberg: *Apparatus for producing illuminating gas from gasolene.* (Germ. P., No. 11121, Feb. 28, 1880.)—Two connected pipes filled with wool, in the first of which an upward current of air comes in contact with the gasolene fed in from a vessel above. The second pipe serves as a purifier.

W. HENDERSON, Irvine: *Treatment of certain ores.* (Engl. P., No. 4481, Nov. 3, 1879.)—Ores containing silver, cobalt, nickel and zinc, are roasted, the oxides mixed with acid sodium sulphate, heated to low redness, and extracted with water containing sulphuric acid.

P. G. L. DESIGNOLLE, Paris: *Extraction of noble metals by means of mechanical and electrochemical amalgamation, and apparatus for the same.* (Germ. P., No. 11415, Feb. 8, 1880.)—The ore is worked together with a slightly acid mercurial solution in a rotating cylinder filled with iron balls. When the amalgamation of the gold is complete, the mass is transferred to a second apparatus, consisting essentially of amalgamated copper or silver plates which retain the gold amalgam contained in the mud received from the cylinder.

W. MÜLLER, Antwerp, and E. GEISENBERGER, Brussels: *Apparatus for obtaining ammonia from atmospheric nitrogen.* (Germ. P., No. 11489, June 19, 1879.)—See their Amer. Pat., this JOURNAL, **2**, 142.

W. CHADWICK et. al., ST. HELENS: *Manufacture of alum and sulphate of alumina free from iron.* (Germ. P., No. 11137, Oct. 10, 1879.)—See their Amer. Pat., this JOURNAL, **2**, 440.

E. NEUMANN, Rosswein: *Method for utilising the waste water from wool-washing establishments and fulling mills.* (Germ. P., No.11112, Dec. 19, 1879.)—The waters are treated in pits with milk of lime, the lime soap thereby formed precipitates the greater part of the impurities. Glue or other nitrogenous matters may subsequently be removed by means of a weak solution of tannin. The deposit of insoluble salts of the fatty acid is subjected to destructive distillation to obtain ammonia, etc.

FERD. CAMUS, Paris: *Treatment of corn and other cereals.* (Germ. P., No. 11501, March 12, 1880.)—The grains are bleached by soaking them in a solution of acid sodium, or calcium sulphite, and adding an acid.

G. F. MEYER, Braunschweig: *Method of filtration of beet juice.* (Germ. P., No. 11296, Feb. 13, 1880.)—Besides sand, mineral, wool, etc., mentioned in his first patent (see this JOURNAL, **1**, 305), the inventor now claims also the use of quartz, coal, coke, and the insoluble compounds of the alkaline earths, as substitutes for bone-black.

P. H. H. NEUMANN, Brussels: *Method of rendering parchment paper opaque and pliable.* (Germ. P., No. 10008, Jan. 8, 1880.)—The property mentioned is given to it by adding baryta salts to the pulp, or applying them in the solution to the paper before the treatment with sulphuric acid, the latter by adding calcium chloride or other hygroscopic substance.

H. GUETTLER, Kriewald: *Use of dextrine in the preparation of cartridges from compressed blasting powder.* (Germ. P., No. 10978, Dec. 3, 1879.)—The mixture is impregnated with solution of dextrine and the plastic mass compressed. A coating of shellac renders it waterproof.

T. H. COBLEY and W. G. GARD, Dunstable: *Method of preparing tannin black for printing ink, blacking, etc.* (Number and date of patent not given.)—Leather waste and animal matters containing glue or gelatine, and materials containing tannin, are extracted with alkaline water. The solution is then precipitated with an iron salt, and the precipitate mixed with tar oil.

CHARLES WIGG, Liverpool: *Manufacture of potassium and sodium sulphate.* (Engl. P., No. 5105, Dec. 13, 1879.)—Superheated steam is injected into the sulphate furnace. The hydrochloric acid gas evolved being free from air, can be more readily condensed.

HENRY BRUNNER, Widnes: *Manufacture of soda.* (Engl. P., No. 5228, Dec. 22, 1879.)—The inventor adds sodium nitrate, or the oxides or carbonates of zinc, lead, iron and manganese, to the lyes to oxidise or decompose sulphides, and to remove silicate of alumina, etc.

G. BORSCHE, Leopoldshall: *Improvements in the method of obtaining potassium-magnesium sulphate and carnallite from kainite.* (Germ. P., No. 11028, Dec. 4, 1879; addition to Germ. P., No. 10642, see this JOURNAL, **3**, 70.)—Sodium sulphate may be employed instead of magnesium sulphate for the purpose of precipitating the potassium-magnesium sulphate.

R. POWELL, Liverpool: *Manufacture of calcium sulphite.* (Engl. P., No. 5109, Dec. 13, 1879.)—Dry process. Sulphurous acid is brought into contact with pulverised lime, or with calcium carbonate, in a series of lead chambers.

GEBRUEDER RAMDOHR, Wanzleben: *Manufacture of magnesia from magnesium chloride.* (Germ. P., No. 11746, March 7, 1880; addition to Germ. P., No. 11580, Oct. 9, 1879.)—The solution of magnesium chloride is evaporated by direct application of an oxidising flame, and heated in presence of superheated steam to drive off a large part of the hydrochloric acid. The residual mixture of MgO and $MgCl_2$ is mixed with iron ore or clay, and formed into bricks which are burned at a high temperature in presence of steam.

H. UELSMANN, Koenigshuette: *Use of silicious iron in galvanic batteries.* (Germ. P., No. 11284, May 11, 1880.)—The iron in a zinc-iron battery is replaced by pig iron containing 12 per cent. of silicium.

JAMES MACTEAR, Glasgow: *Preparation of crystalline carbon.* (Engl. P., No. 5143, Dec. 16, 1879.)—The inventor proposes to prepare carbon in a diamond-like form by subjecting carbon compounds to a very high pressure and high temperature, preferably in presence of a body capable of uniting with the elements combined with the carbon in such compounds.

JAMES MACTEAR, Glasgow: *Preparation of crystallised carbon.* (Engl. P., No. 45, Jan. 6, 1880.)—Carbonic acid and finely divided iron, or oxalic acid and oxidisable metals, are heated for 70 hours in steel vessels to a temperature of 300 to 400° C. The finely crystallised carbon so obtained, is intended to be used as a substitute for emery.

A. BAEYER, Munich: *Preparation of the derivatives of orthonitrocinnamic acid, the homologues and substitution compounds of these derivatives, and conversion of the same into indigo-blue and analogous coloring matters.* (Germ. P., No. 11857, March 19, 1880.)

A. BAEYER, Munich: *Improvements in the methods of preparing the materials used in the manufacture of indigo, and method for the direct production of this coloring matter upon the fiber.* (Germ. P., No. 11858, March 19, 1880; addition to Germ. P., No. 11857.)—See Prof. Baeyer's American patents, this JOURNAL, **2**, 228, 295, 403 and 457.

A. ENGELER, Winterthur: *Dry method of bleaching cotton by the use of chloroform vapors containing chlorine.* (Germ. P., No. 12127, June 26, 1880.)—The bleaching gas is prepared by allowing sulphuric acid to react upon one part unslaked lime, one part chloride of lime, and one part alcohol.

ORAZIO LUGO, Flushing, and W. T. LEES, Brooklyn: *Improvements in the purification of gas.* (Germ. P., No. 11247, Dec. 19, 1879.)—The crude gas is mixed, between the condenser and the scrubber, with 1 to 2 per cent. of air, and the mixture heated to 250° by means of superheated steam.

A. NOBEL, Paris: *Application of compressed gunpowder in combination with fulminating cartridges composed of dynamite, or of a mixture of gunpowder and dynamite, nitrogelatine, nitrocellulose, bipicrate of baryta, lead or potassa, for blasting purposes.* (Germ. P., No. 11030, Jan. 6, 1880.)—The object of this invention is to render compressed, ungrained gunpowder serviceable for blasting.

V. HAENING, Dresden, and O. REINHARD, Loschwitz: *Extractor with return condenser.* (Germ. P., No. 10771, Feb. 10, 1880; addition to Germ. P., No. 6737.)—The apparatus is composed of two parts. The upper one contains the matter to be extracted, the lower one the extracting liquid. The cover forms the return condenser, being so shaped as to hold the cooling water. Immediately below this, and connected with it, is the cooling pipe. By means of a branch pipe direct steam can be admitted to the upper compartment, whence it passes as extract into the lower one. As soon as sufficient liquid has collected here, the steam by the branch pipe is shut off, and the process of extracting carried on in the usual way.

I. BALLATSCHEANO, C. BALLATSCHEANO and H. TRENK, Berlin: *Method of tanning.* (Germ. P., No. 11031, Jan. 10, 1880.)—The following three baths are employed: 1. A solution of chromate of alumina in wood alcohol; 2. A concentrated solution of cream of tartar and nickel-ammonium chloride; 3. A solution of 1 to 2 parts tannin in 1,000 pts. water, and 20 to 25 parts of wood alcohol.

G. PRAETORIUS, Breslau: *Method of making porous objects and vessels of earthenware to be used for filtration, absorption and dialysis.* (Germ. P., No. 11810, Oct. 9, 1879.)—Charcoal powder is added to the clay to produce porosity.

R. A. FISHER, Philadelphia: *Neutral combination of aluminium and zinc sulphate for paper manufacture.* (Engl. P., No. 170, Jan. 14, 1880.)—Oxide of zinc is dissolved in a solution of aluminium sulphate until it is so neutral as not to change coloring matters.

H. GERNER, New York: *Treatment of caoutchouc, gutta-percha, etc.* (Engl. P., No. 47, Jan. 6, 1880.)—Camphor dissolved in alcohol or benzole is incorporated with the mass before vulcanising.

I. A. W. WOLTERS, Dresden: *Method of preparing sulphuric anhydride.* (Germ. P., Jan. 7, 1880.)—Alkaline pyrosulphates are decomposed with sulphuric acid.

$$R_2S_2O_7 + H_2SO_4 = 2RHSO_4 + SO_3.$$

The acid sulphate remaining after the distillation is reconverted into pyrosulphate by heating.

Mr. HELLOFF, Berlin: *Blasting compounds.* (Germ. P., No. 12122, June 3, 1880.)—Crude tar oil is treated with concentrated nitric acid. The nitro-compounds formed are mixed with chlorates or nitrates, or with nitric acid.

B. BERNHARDI, Stassfurt: *Combined method for the manufacture of schoenite, potassium sulphate and chloride.* (Germ. P., No. 12498, April 13, 1880.)—Relates to the employment of lyes resulting from the manufacture of schoenite, or potassium sulphate, instead of water, in the preparation of potassium salts.

R. S. NEWALL, Gateshead upon Tyne: *Calcining furnace.* (Engl. P., No. 5230, Dec. 22, 1879.)—Improvement upon Mactear's rotating furnace.

I. H. WILHELM, Homburg, v. d. H., and F. BOHNSTADT, Frankfort, a. M.: *Manufacture of printing ink from coal tar.* (Germ. P., No. 12282, Dec. 25, 1879.)—Coal tar is mixed with 6 to 15 per cent. of rosin and 10 per cent. of paraffine oil, and strained. After deodorising with chloride of lime, or potassa, 20 to 25 per cent. of glycerine and 12 to 18 per cent. of lamp-black are added to it. According to an additional patent (Germ. P., No. 12286, Jan. 9, 1880), the tar is first treated with 2½ to 3 per cent. of sulphuric acid, neutralised with soda, and deodorised with chlorine as above. Finally lard, glycerine, soap, etc., are added.

M. SALZMANN and F. KRÜGER, Fürstenberg, a. O.: *Preparation of red, violet and green coloring matters by the action of chloropicrine upon aromatic amines.* (Germ. P., No. 12096, March 17, 1880.)—Aniline and its homologues are heated with chloropicrine at 110°–120° C. for some time. Red coloring matters, soluble in water, and violet ones, soluble in alcohol, are produced. The part soluble in water is precipitated with salt; the insoluble part is converted into the sulphonic acid. Instead of the bases their salts may be employed, and the reaction may take place in the presence of metallic salts.

O. KOHLRAUSCH, Vienna: *Method of obtaining tannic acid and extracts of dyewoods by means of dialysis.* (Germ. P., No. 12296, Dec. 11, 1880.)—Instead of rasping the wood, it is cut into thin chips and treated with hot water in a diffusion battery which is similar to those employed for extracting sugar from beets.

I. P. CLOSSON, Paris: *Improvements in the process of obtaining magnesia from dolomite.* (Germ. P., No. 12456, Oct. 23, 1879.)—A solution of calcium and magnesium chloride is prepared by decomposing calcined dolomite with manganous chloride from the manufacture of chlorine, or with ferrous chloride (from pyrites), or with ammonium chloride from the ammonia-soda process, etc.; hydroxide of manganese, hydroxide of iron and ammonia being respectively formed. The solution of magnesium and calcium chloride is treated with additional quantities of calcined dolomite powder to precipitate the magnesia.

T. F. WILKINS, Clapham: *Preservation of fish.* (Engl. P., No. 501, Feb. 4, 1880.)—Treatment with a solution of metaphosphoric acid and sugar.

I. MACGAAN, Liverpool: *Manufacture of spirits and fermented liquors.* (Engl. P., No. 512, Feb. 5, 1880.)—Glucose prepared by digesting Indian meal with sulphuric acid is subjected to fermentation. The following salts are added to serve as nutriment for the yeast: Acid potassium phosphate (1.3 pts.), potassium carbonate (0.86 pts.), potassium silicate (0.04 pts.), ammonium tartrate (1.50 pts.), ferrous sulphate (0.17 pts.)

C. C. WALKER, Sallop: *Purification of coal gas.* (Engl. P., No. 545, Feb. 7, 1880.)—Before passing to the scrubber the gas is led through one or more small towers containing a number of metallic screens which are intended to retain any tar carried over.

T. A. EDISON, Menlo Park: *Anaesthetic.* (Engl. P., No. 599, Feb. 11, 1880.)—Composed of chloral hydrate, alcohol, chloroform, camphor, oil of peppermint, oil of cloves, salicylic acid, amyl nitrate, morphine sulphate and ether.

JOS. A. LANFREY and J. L. RENARD, Chartres: *Improvements in the preparation of nitrocellulose paper.* (Germ. P., No. 12115, Jan. 21, 1880.)—The object of this invention is the manufacture of an explosive compound composed essentially of nitrocellulose from straw. This nitrocellulose can absorb 75 per cent. of nitroglycerine.

ADOLPH BAEYER, Munich: *Manufacture of artificial indigo and analogous coloring matters from orthonitrocinnamic acid, and its homologues and substitution products.* (Germ. P., No. 12601, June 18, 1880; second additional patent to No. 11857, of March 19, 1880.)—From the above mentioned substances, orthonitrophenylpropiolic acid, its homologues or substitution products are prepared; these are dissolved in cold concentrated sulphuric acid, and treated with sulphate of iron. In consequence of the reducing action of the sulphate of iron, indigo blue, or homologues and substitution products of it, are formed according to the following equation:

$$2C_9H_5NO_4 = C_{16}H_{10}N_2O_2 + 2CO_2 + O_2.$$

H. F. PEASE, W. JONES and JOHN WALSH, Middlesborough, o. T.: *Improvements in rotating furnaces and pans used in the manufacture of potassium and sodium sulphate.* (Germ. P., No 11953, April 18, 1880; addition to Germ. P., No. 1125, Oct. 20, 1877.)—The improvements relate to stirring and discharging arrangements in a rotating sulphate furnace.

I. B. FREEMAN, London: *Manufacture of zinc-white.* (Engl. P., No. 5121, Dec. 13, 1879.)—In order to give the zinc-white more body, the inventor crushes it under extra heavy mill-stones.

OTTO SANDER, Beuel, near Bonn: *Manufacture of silicic acid from furnace slag, and use of the same for purifying oils.* (Germ. P., No. 11951, April 3, 1880.)—Silicic acid obtained by decomposing the slag with sulphuric or hydrochloric acid is boiled with, or used for, filtering dark mineral oils after their treatment with caustic lye and sulphuric acid.

C. VON BUCH, Oxford: *Crystallisation of carbon.* (Engl. P., No. 804, Feb. 24, 1880.)—Vapor of carbon disulphide is subjected, under pressure in a heated glass tube from which the air has been removed, to a current from a Leclanché battery for several weeks. More vapor is forced into the tube from time to time. Transparent crystals are deposited which yielded carbonic acid by combustion in oxygen.

According to a second method, aluminium fluoride is heated to whiteness in a crucible with ammonium carbonate or other carbon compound. The fluorine is said to combine with the carbon, and to yield it again in the crystalline form.

A third process (Engl. P., No. 830, Feb. 29, 1880) is based upon the property which gases, like carbonic acid, possess under high pressure, of dissolving

carbon and separating it in a crystalline form under the influence of electric discharges, or diminished pressure.

JOHN SATTISON, Nevada City: *Method of controlling the explosion of blasting compounds containing potassium chlorate.* (Engl. P., No. 810, Feb. 24, 1880.)—Coarsely pulverised mustard seed, or linseed, is added to the mass to prevent the formation of hard cakes which, by rubbing against each other, often cause spontaneous explosion of the cartridges.

H. DESPECHER, Paris: *Apparatus for distilling substances containing hydrogen.* (Germ. P., No. 9451, Dec. 10, 1878.)—The method relates to the distillation of coal or other substances containing hydrogen and carbon. A limited amount of highly heated air, as rich in nitrogen as possible, being admitted to the furnace, the hydrogen is said to combine, and to form water and ammonia.

B. THUEMMLER and F. E. SEIDEL, Dresden: *Improvements in the treatment of fibers for the purpose of rendering them suitable for spinning.* (Germ. P., No. 11729, Jan. 21, 1880.)—The stalks of nettles, flax, hemp, jute, etc., are crushed, steamed, then treated with milk of lime and caustic soda. Gum, mucilaginous matters, etc., having thereby been removed, the fibers are subjected to bleaching agents. They are then successively treated with an alkaline carbonate, sulphurous acid, soap water and glycerine vapor.

L. MCINTYRE, Glasgow: *Treatment of fish and fish waste for the purpose of utilising the solid, liquid and gaseous products from them, and apparatus therefor.* (Germ. P., No. 12349, Jan. 1, 1880.)—The material is heated in a rotating cylinder surrounded by a steam jacket. The vapors evolved are passed into sulphuric acid to absorb the ammonia. From the liquid matters which the waste yields, oil is obtained. The dry matters are valuable as manure, or they may be used in the manufacture of murexid, on account of the uric acid contained in them.

H. V. HAIG, Cameron Bridge: *Manufacture of yeast.* (Engl. P., No. 5106, Dec. 13, 1879.)

JUL. STEUER, Blasewitz: *Manufacture of artificial mill-stones, grind-stones and rollers.* (Germ. P., No. 11507, March 31, 1880.)—20 to 70 pts. quartz sand, 70 to 20 pts. porphyry and 5 pts. feldspar, calcareous spar, or fluor spar, are finely ground, mixed with 5 pts. solution of silicate of soda, formed in moulds, and calcined.

L. WOLLHEIM, Vienna: *Apparatus for collecting non-metallic solid products of electrolytic decomposition.* (Germ. P., No. 11737, May 25, 1880.)—The plate-shaped electrodes are contained in a trough which is so arranged that the liquid to be decomposed enters continuously at the upper end, whilst the products of decomposition pass out through channels near the bottom.

W. KNAUER, Osmuende: *Purification of waste waters from sugar works and other industrial establishments.* (Germ. P., No. 12552, Aug. 1, 1880.)—Instead of purifying the waters, as described in a previous patent, the inventor proposes to allow them to flow over a surface cooler, arranged in the form of a terrace placed under roof.

SACHSENROEDER and GOTTFRIED, Leipsic: *Liquid refined sugar.* (Germ. P., No. 11964, May 23, 1880.)—Dissolved sugar is evaporated with citric or tartaric acid, after which the acid is neutralised with bicarbonate of soda.

H. DRENKEMANN and M. MEIXNER, Basle: *Preparation of pencils for glass painting.* (Germ. P., No. 12662, May 23, 1880.)—Metallic colors are formed into pencils by means of a mixture of 2 pts. stearine oil and 6 pts. stearic acid.

E. CAREY, H. GASKELL and J. HURTER, Widnes: *Purification of alkaline solutions, and generation of ammonia.* (Engl. P., No. 608, Feb. 11, 1880.)—The alkaline solution is first treated with carbonic acid to precipitate alumina and silicic acid, after which the sulphides are oxidised by means of manganic oxide or sodium nitrate. Ammonia is generated when sodium nitrate is employed for oxidising the heated solution—

$$2NaS + NaNO_3 + 3H_2O = 3NaHO + Na_2S_2O_3 + NH_3.$$

H. and E. ALBERT, Biebrich: *Extraction of difficultly soluble phosphoric acid from calcic phosphates which have been treated with sulphuric acid.* (Germ. P., No. 12501, May 19, 1880.)—About one hour after the phosphates have been mixed with the acid the mixture is passed through a wet mill. With the aid of a filter press all the phosphoric acid not combined with iron or alumina can be obtained.

JULIAN DENBY, Huelva: *Dephosphorising iron.* (Engl. P., No. 690, Feb. 15, 1880.)—Carbonic oxide or ammonia are blown together with the air, or before or afterwards, through the molten iron contained in a Bessemer converter.

H. UELSMANN, Koenigshuette: *Use of ferrosilicon for apparatus and vessels to contain acids.* (Germ. P., No. 12464, June 15, 1880.)—Iron containing 12 per cent. or more, of silicon is acid proof (see also this JOURNAL, 3, 73).

C. W. SIEMENS, London: *Process and apparatus for compressing molten metals and other substances.* (Germ. P., No. 12037, June 29, 1880.)—Volatile substances such as water, ammonium carbonate, mixtures of nitrates and carbon, are, by means of the cover, introduced into the mould containing the liquid steel. The vapors from the substances volatilized by the heat of the metal exert a pressure upon the contents of the mould.

JOHN BENBOW and H. W. SHEPARD, Brooklyn, and R. SEAMAN, New York: *Improvements in the method of coating iron with other metals.* (Engl. P., date and number not given.)—Organic chlorides are employed in conjunction with the metallic chlorides usually employed in galvanising sheet iron.

COUNT DU CHASTENET D'ESTERRE, Paris: *Gilding metals.* (Engl. P., No. 709, Feb. 17, 1880.)—The objects to be gilded are coated with an enamel composed of alumina, cobalt, red lead, boracic acid and powdered glass, and baked. They are then brushed over with the gilding solution, containing gold, tin, arsenious acid, sulphur dissolved in oil of turpentine and oil of lavender, whereupon they are baked.

S. WALKER, Birmingham: *Use of cryolith and sugar of lead in melting copper and obtaining it in compact and even castings.* (Germ. P., No. 12576, April 2, 1880.)—The above mentioned substances are employed alone or together with borax.

W. H. HOOPES, Baltimore: *Manufacture of artificial stone.* (Engl. P., No. 741, Feb. 19, 1880; Germ. P., No. 11783, Feb. 26, 1880.)

GEBRUEDER SCHENK, Heidelberg: *Plastic mass.* (Engl. P., No. 650, Feb. 14, 1880.)—Called "tripolith," a substitute for plaster of Paris, over which it is said to have advantages.

J. C. BLOOMFIELD, Castle Cardwell, Ireland: *White cement.* (Engl. P., No. 738, Feb. 19, 1880.)—Lime mixed with 5 per cent. plaster of Paris and with an equal weight pulverised quartz or flint.

G. T. LEWIS, Philadelphia: *Improvements in the manufacture of white lead.* (Engl. P., No. 730, Feb. 18, 1880.)—The lead smoke is blown into a clay retort or muffle heated from the outside so that mixing with the gases from the fire is avoided.

F. G. KROMSCHROEDER, London: *Improvements in the manufacture of illuminating gas.* (Engl. P., No. 619, Feb. 12, 1880.)—Relates to a process of carburetting the gas by passing it through sponges, etc., saturated with hydrocarbons. Excess of the latter is removed by allowing the gas to traverse a compartment of the apparatus in which strips of flannel soaked with acetic acid are suspended.

R. COMBERT, Paris: *Apparatus for purifying oils and fats.* (Germ. P., No. 11460, March 13, 1880.)—The oil is injected by means of steam into the vessel containing the purifying liquid.

J. B. HANNAY, Glasgow: *Antiseptic.* (Engl. P., number not stated.)—Intended for protecting ships' bottoms. It is composed of 45 pts. naphtha, 32 pts. rosin, 12 pts. turpentine and 10 pts. linseed oil, to which arsenite, or chromate of mercury may be added.

JOSEPH DUKE, Totnes: *Fertiliser.* (Engl. P., No. 748, Jan. 20, 1880.)—Gas liquor, sewage, etc., is filtered through a mixture of soluble silicates, superphosphate and peat coke, which retain the nitrogenous matters.

H. W. VOGEL, Berlin: *Improvements in the preparation of photographic emulsions.* (Germ. P., No. 12416. May 8, 1880.)—Four processes are given for combining silver bromide and gelatine emulsions with pyroxyline. The emulsions may be used in the dry or wet condition.

S. W. RIESS, Croydon: *Hair dye.* (Engl. P., No. 5049, Dec. 9, 1879.)—Manganous acetate and pyrogallic acid with addition of glycerine.

E. S. DAUZIVILLÉ, Paris: *Convertion of wood pulp into glucose and alcohol, and apparatus for same.* (Germ. P., No. 11836, March 23, 1880.)—Wood pulp moistened with hydrochloric acid is exposed in acid proof cylinders to the action of hydrochloric acid gas, and then systematically extracted.

C. PIEPER, Berlin: *Method of preparing saccharate of lime from sirup.* (Germ. P., No. 11342, Oct. 14, 1879.)—Powdered caustic lime and powdered "sirup lime," together with sirup, are passed continuously into a mixing apparatus which can be heated. The stiff paste leaving this apparatus upon an endless belt is cooled and dried in a current of air, and coarsely powdered in a disintegrator.

THE AMERICAN CHEMICAL SOCIETY.

XIX.—Proceedings.

Regular Meeting, Friday, September 2d, 1881.

The meeting was called to order, at 8:45 P. M., Dr. A. R. Leeds in the chair.

The minutes of the previous meeting were read, and approved.

As there had been no meeting of the Board of Directors, the Chair then called upon the Committee on Papers and Publications to report.

Dr. Endemann, in reference to the proceedings, said that all the matter is now in type, and that he expected the Journal would be out in a few days.

The Librarian then reported that the collection of old books, formerly belonging to Prof. Trooste, and presented to the Society by Dr. Lindsly, contains:

	WORKS.	VOLUMES.
Pharmaceutical	7	10
Physics and chemistry	13	30
Special subjects, phys. and chem.	6	6
Metallurgy	26	29
	52	75

As there were no gentlemen to be elected, the next in order was the nomination of new members. The following gentlemen were nominated:

As members:

Albert L. Colby, Ph.B.

Proposed by { Arthur H. Elliott, Elwyn Waller, Albert R. Leeds.

Dr. Harry von Bauer.

Proposed by { H. Endemann, James H. Stebbins, Jr., P. Casamajor.

Dr. P. RADENHAUSEN.

Proposed by { H. ENDEMANN, JAMES H. STEBBINS, JR., P. CASAMAJOR.

Dr. LOUIS HABEL.

Proposed by { H. ENDEMANN, J. F. BATTERSHALL, M. BENJAMIN.

H. C. HIEPE.

Proposed by { H. ENDEMANN, JAMES H. STEBBINS, JR., J. F. BATTERSHALL.

WM. L. LEMAN.

Proposed by { T. J. PARKER, P. CASAMAJOR, E. WALLER.

The resignation of Mr. WM. D. MASON was then read and accepted.

The first paper of the evening, "On the Detection of Oleomargarine," by Mr. P. CASAMAJOR was then read by the author.

The detection of this substance is based upon the specific gravity of fats in alcohol, of about 54 per cent., oleomargarine floating in it, whereas the butter sinks to the bottom.

The second paper, "On the Detection of Starch Sugar Syrup, mixed with Sugar-house Syrup," by Mr. P. CASAMAJOR, then followed.

This test depends upon the solubility of sugar-house syrup, in methyl alcohol, while the starch sugar syrup is thrown down as a precipitate. For 1 vol. of syrup it requires about 3 vols. of alcohol, to complete the separation.

The third paper, "On a short Table for testing Sugar by Inversion," by Mr. P. CASAMAJOR, was then read.

The fourth paper, "On a new form of Apparatus for Gas Analysis," by Mr. ARTHUR H. ELLIOTT, then followed. With this apparatus the large amount of washing (as in the case with the Wilkinson apparatus) is done away with. Mr. ELLIOTT found that this washing reduced the illuminants as much as two per cent.

Some remarks by Dr. ENDEMANN and Mr. STEBBINS then followed.

The meeting was then adjourned.

JAMES H. STEBBINS, JR.,
Recording Secretary.

XX.—Detection of Oleomargarine.

By P. Casamajor.

In the *Moniteur Scientifique* for April, 1881, is an article on Butter Analysis, in which are given the processes used at the Municipal Laboratory, attached to the Prefecture of Police in Paris, for the detection of foreign fats in butter. This is followed by an account of an areometric method used for the same purpose, and based on the difference of density between butter and the fats with low melting point, extracted from tallow, which are made to resemble genuine butter, and which are known under the commercial name of *oleomargarine.*

The sale of oleomargarine has become so extensive in this country, that a purchaser of butter is never sure whether he is getting true butter or its imitation. In view of this fact, I have thought it useful to give a process, based on the difference of specific gravity between butter and oleomargarine, of such simplicity that it can be easily applied by any person having rudimentary ideas of manipulation.

Processes of this character are those which can be used with greatest efficiency to check adulterations. I have, in previous communications, given such processes for the detection of starch sugar mixed with cane sugar, and for the detection of starch sugar syrup, mixed with sugar-house syrup.

Although my concern is principally with the difference of density between butter and oleomargarine, I propose to very briefly call attention to the processes used at the Municipal Laboratory of the Prefecture of Police, as these show important differences in chemical composition between true butter and its adulterant, which confirm the difference in the specific gravity. Such an important character as the specific gravity would not differ to any marked extent, without a corresponding diversity in the composition of the two substances.

One process used at the Municipal Laboratory is the following: The sample of butter to be tested is melted, so as to separate water, salt, etc., which is deposited, and a certain amount of scum, which comes to the surface. Of the clear melted fat, under the scum, about 3 or 4 grms. are taken and saponified by 1 or 2 grms. of potassic hydrate. The fat and potassa should be mixed with 50 c.c. of alcohol. In about 5 minutes the saponification is complete, and the cautious addition of water should not produce any turbidity. If any takes place, the operation must be begun anew. The soap formed is afterwards decomposed with weak sulphuric acid, and the insoluble

fat acids are collected and weighed. The result of a great number of experiments is, that in butter the percentage of fat acids thus obtained is usually 86.5 to 87.5 per cent., and that sometimes it is as high as 88 per cent. In animal fats from tallow the percentage of insoluble fat acids is $95\frac{1}{2}$. The difference, $95\frac{1}{2} - 87\frac{1}{2} = 8$ per cent., is attributed to the absence in tallow of volatile and soluble fat acids which exist in butter.

Another process is given in which the result is obtained volumetrically, by estimating the quantity of potassa used in saponifying the fat. 1 grm. of butter requires 225 to 232.4 c.c. of potassa solution, while 1 grm. of tallow, or other animal fat of the same nature, requires from 195 to 197 grms. of the same potassa solution.

Mr. Charles Girard, director of the Municipal Laboratory, considers as adulterated any butter requiring, for saponification, less than 221.5 c.c. of the potassa solution. In some unfavorable cases this volume may represent nearly 30 per cent. of foreign fat.

The method for detecting the difference between butter and oleomargarine by the difference of specific gravity, is one proposed by Messrs. Leune and Harburet.

The butter to be tested is first melted, so as to separate the pure fat from water, salt, etc. The clear melted fat is placed in a cylinder, heated by the vapor escaping from a water bath, kept boiling, but no part of the cylinder is to be in the boiling water. I understand that by heating in this way, the temperature of the melted fat remains at about 93° C. To determine the density of this fat an areometer is placed in it. This areometer is graduated in such a way that, in butter, it will sink to the lowest mark of the scale, while oleomargarine corresponds to the highest point in the graduation. The intervening space is divided into ten equal parts, each one of which corresponds to $\frac{1}{10}$ of oleomargarine, mixed with butter. More than 600 experiments made by Messrs. Leune and Harburet, with artificial mixtures, show that, within an approximation of ten per cent., the instrument gives correct results.

Soon after this areometric method was published, it was announced that the difference of the specific gravities of butter and of oleomargarine, was too slight to distinguish the one from the other. As Messrs. Leune and Harburet had not stated what the specific gravity of each was, it was impossible to judge of the truth of this statement, and it became interesting to ascertain the facts of the case. The following process is the result of my attempts to deter-

mine the specific gravities of butter and of oleomargarine : I chose, in the first place, to ascertain the specific gravity of each at 15° C., which is the usual temperature for such determinations. The process consisted in finding for each a liquid in which, at 15° C., a portion of butter or of oleomargarine, freed from impurities by previous melting, and containing no air bubbles, would remain in equilibrium in any portion of the liquid, without any tendency to rise to the top or sink to the bottom. The readiest liquid for this purpose was a mixture of alcohol and water, as this is easily prepared and it has no dissolving action on the fats to be tested. As the density of the liquid in which a body remains in equilibrium is the density of the body itself, the problem was narrowed down to finding the difference of density between two mixtures of alcohol and water of different strengths. It was found that pure butter, at 15° C., would remain in equilibrium in alcohol of 53.7 per cent. This corresponds to specific gravity 0.926. This butter was obtained from a gentleman at whose country place the butter was made. I obtained oleomargarine from melted warm beef suet by pressure. At a temperature of 25° C., this expressed fat had the consistency of butter. The alcohol, which at 15° C. would hold it in equilibrium, had a strength of 59.2 per cent., which corresponds to a specific gravity of 0.915.

The question of the possibility of distinguishing butter from oleomargarine becomes equivalent to the possibility of distinguishing alcohol of 53.7 per cent. from alcohol of 59.2 per cent. As this difference is 5.5 degrees of Gay Lussac's alcohometer, it is very evident that the specific gravity is a sufficient character for distinguishing butter from oleomargarine. This difference may appear more clearly to persons not familiar with alcohometry, by stating that it is the difference between 0.926 specific gravity and 0.915.

By means of the tables of Gay Lussac and of Tralles,* it is a very easy matter to prepare alcohol of the required strength at any temperature, to be kept in bottles for future use.

As the expansion of fats is different from that of alcohol, it is advisable to bring the alcohol to 15° C. when making an observation, which can be easily done by any one provided with a thermometer.

To deliver the sample of fat on the alcohol, I have found that the best plan is to melt the fat and let a large drop of it fall into the liquid. The fat should be melted in a little spoon or a little scoop, and the drop should be delivered by bringing the spoon or scoop close to the surface of the alcohol. It requires a little practice to do this neatly, so

* See the excellent tables of Prof. McCulloh.

as not to get an air bubble in the ball of melted fat. When an air bubble becomes imprisoned in the fat, I have had no difficulty in removing it with a strip of paper, while it lies on top of the alcohol. Sometimes the globule of fat only partially sinks in the alcohol; the top of it becomes flat and remains exposed above the liquid. A slight tap on the side of the glass is then generally sufficient to form a wave and sink the globule.

If we take alcohol of 56½ per cent., which represents equal volumes of alcohol of 53.7 per cent. and of 59.2 per cent., and if we deliver on the surface of this alcohol a globule of melted butter and one of oleomargarine, the butter will sink to the bottom and the oleomargarine will remain at the top, while the two globules are still warm and liquid. Afterwards, if the alcohol has a temperature of about 30° C., the butter will become solid, while the oleomargarine may still remain liquid. Then the butter will rise to the top of the alcohol, which is due to the expansion of butter on solidifying. If the alcohol be then kept for a few minutes at 15° C., the oleomargarine will become opaque and remain at the top, while the solid globule of butter will sink to the bottom.

If instead of taking alcohol of 56 per cent., we use alcohol of 59.2 per cent., oleomargarine will remain on top, and butter will sink to the bottom at all temperatures above 15° C. At 15° C., oleomargarine will remain in equilibrium in any portion of the liquid in which it may be placed.

If oleomargarine was always sold pure, the foregoing indications would be sufficient to distinguish it from butter, but the oleomargarine found in the market is always more or less mixed with true butter, to improve its taste and appearance. This being the case, alcohol of 59 per cent. is not the proper liquid to detect oleomargarine. We should use alcohol of 55 per cent., and consider as oleomargarine any so-called butter which will not sink to the bottom in alcohol of this strength at 15° C. This is founded on the fact that not more than one-third of butter is ever mixed with oleomargarine to improve its taste and appearance.

Bearing in mind the experiments of Messrs. Leune and Harburet, already cited, the proportion of butter and of oleomargarine in a mixture could be easily detected by finding what strength of alcohol will hold in equilibrium at 15° C., a globule of fat under examination. As the difference of 59.2 and 53.7 is 5.5, the proportion of oleomargarine is the difference between the strength of the alcohol and 53.7, divided by 5.5, or more conveniently multiplied by 0.18. If the

alcohol required to hold a globule of fat in equilibrium at 15° C., has a strength of 57 per cent., then: $(57 - 53.7) \times 0.18 = 3.3 \times 0.18 = 5.95$, or say $\frac{6}{10}$ of oleomargarine. If the alcohol had a strength of 58, then $(58 - 53.7) \times 0.18 = 4.3 \times 0.18 = 7.72$, or about $\frac{8}{10}$ of oleomargarine.

The proportions of butter and oleomargarine in a mixture may be also determined without the aid of an alcohometer, by using the two solutions of 53.7 per cent. and of 59.2 per cent. These may be placed in graduated glasses and poured cautiously into a third glass, until an alcohol of sufficient strength is obtained to keep in equilibrium a globule of the fat under examination, at 15° C.

The relative volumes of the two solutions used in making the mixture, give the proportions of butter and oleomargarine.

XXI.—Detection of Starch Sugar Syrup Mixed with Sugar-House Molasses.

By P. Casamajor.

In previous communications I have given processes for detecting the adulteration of cane sugar by starch sugar. The adulteration of sugar-house syrups by starch glucose is still more extensively practised than that of sugar, and a great portion of the syrups sold by retailers in this market is mixed with starch glucose.

This form of adulteration may be very easily detected by the use of strong methylic alcohol, in which the alcohometer of Tralles, or of Gay Lussac, will indicate about 93½°.

A straight sugar-house syrup, when mixed with three times its volume of this strong methylic alcohol, will dissolve by stirring, giving a very slight turbidity, which remains suspended, while yrups c ontaining the usual admixture of starch sugar give a very turbid liquid, which separates, when left at rest, into two layers, the lower being a thick viscous deposit containing the glucose syrup.

Considerable quantities are sold of a thin syrup, of about 32° Beaumé, in which the proportion of sugar to the impurities is greater than in common sugar-house molasses. When a syrup of this kind is stirred with three times its volume of methylic alcohol, a marked turbidity and deposition will take place, which consists of pure sugar. The crystals are hard and gritty; they adhere to the sides of the glass, and are deposited on the bottom. There is no resemblance between this precipitate and that due to starch sugar syrup.

It may not be useless to mention, that if a straight sugar-house

syrup, of about 40° Beaumé density, is stirred with three times its volume of ethylic alcohol of about 93½°, the syrup will not dissolve. Hence, ethylic alcohol of this strength is not suitable for distinguishing a syrup mixed with starch glucose syrup from a straight sugar-house syrup.

The presence of starch sugar in sugar-house molasses may be easily detected by the optical saccharometer, when the syrup has the usual density of about 40° Beaumé, and when starch syrup has been added in the usual quantities.

For making the test, the usual weight should be taken (16.35 grms. for Duboscq's saccharometer, and 26.048 grms. for Ventzke's instrument). The direct test should show a percentage of sugar not higher than the number of Beaumé degrees indicating the density, and it may be from 1 to 3 per cent. lower. To understand this we must refer to the composition of cane sugar molasses of 40° Beaumé:

Sugar	37.5
Soluble impurities	37.5
Water	25.0

If the direct test should indicate 55 per cent. of sugar, and if the molasses was straight, the composition would be:

Sugar	55
Soluble impurities	20
Water	25

Now, a product of this composition would not be a clear syrup at 40° Beaumé, but a mixture of syrup and crystals. Therefore, if the product is a clear syrup of 40° Beaumé, and it tests 55 per cent., it cannot be *straight.*—*Q.E.D.*

The presence of starch sugar in a sugar-house molasses may also be detected by the copper test. The possibility of applying this test, as well as those already indicated, rests on the fact that starch glucose is always added in very large quantities for the purpose of adulteration. A small addition could not be satisfactorily detected.

The detection by the copper test rests on the observation that about one-half of the soluble impurities in sugar-house molasses consists of glucose in the shape of inverted sugar. We have seen above that for a molasses of 40° Beaumé, the soluble impurities amount to about 37½ per cent. We may then lay down the rule that the percentage of glucose shown by the copper test cannot, in a straight sugar-house molasses, be much greater than one-half the number expressing the density in Beaumé degrees. The reason is obvious from what has been said of the test by the optical saccharometer.

XXII.—Table for the Correction of Saccharimetric Tests by Inversion.

By P. Casamajor.

In a paper "On the Influence of the Variations of Temperature, on the Deviation of Polarized Light by Solutions of Inverted Sugar," published in 1879,* I endeavored to show the principle on which is founded the method, so important in sugar analysis, of correcting the direct test of the optical saccharometer, by taking into account the test after inversion. In this communication I will assume that the reader is familiar with the subject, and I propose to enter only very briefly into it.

Clerget, to whom this method of correction is due, published a table in the *Annales de Chimie et de Physique* (**26**, 3d series, 175), by means of which the desired rectification may be obtained, without the need of any calculation beyond taking the algebraical difference of the indications of the saccharometer, before and after inversion. There is also a table by Dr. Tuchschmid, which is essentially the same as Clerget's. Although these tables are published in several works on sugar, many persons who need to use them find great difficulty in obtaining them. There is the resource of copying them by hand, but they are so extensive that this would involve an amount of labor which few persons like to undertake.

The following table will be found useful by persons who have not those spoken of. It is very short and it would be little trouble to copy it. It requires but one operation more than Clerget's table, which is to multiply the algebraical difference of the two readings by a certain factor, corresponding to the temperature of the inverted sugar at the time of observation.

To understand how the numbers in this table were obtained, we must bear in mind that the deviation due to inverted sugar varies with the temperature. For a solution of inverted sugar giving a deviation of 100 to the right, the indication, after inversion, is 44 to the left, or —44, if the observation is made at 0° C. For every centrigrade degree above 0, the deviation becomes half a degree less of the

* See Journal of the American Chemical Society, **1**, 26; also *Chemical News*, **39**, 212, 234; *The Sugar Cane*, **11**, 296; *Moniteur Scientifique*, Juin, 1879, 647; *Zeitschrift des Vereins*, July, 1879, 683.

negative scale. If we call the temperature t, the law of deviations after inversion is expressed by

$$-\left(44 - \frac{t}{2}\right)$$

For a temperature of 10° C., the deviation is —39; for 20° C., the deviation is —34, etc.

If D is the indication of the saccharometer before inversion, and —D′ the indication after inversion, D + D′ will be the algebraical difference, and, for a solution of pure sugar, with D = 100,

$$D + D' = 144 - \frac{t}{2}$$

If the direct test is not 100, and if we call the correct test Z, we will have

$$\frac{Z}{D + D'} = \frac{100}{144 - \frac{t}{2}}$$

$$\text{Whence } Z = D + D' \times \frac{100}{144 - \frac{t}{2}}$$

If for every degree centigrade, we calculate this quantity :

$$\frac{100}{144 - \frac{t}{2}}$$

we may form a table by writing it opposite to every degree of temperature. We will then have in a second column the factors by which to multiply the difference of the indications, before and after inversion, to obtain correct results.

Numerical Example.—If the direct reading of the saccharometer is 90, and, after inversion, —27, the temperature being 25° C., then D + D′ = 117. Referring to the table, we find, opposite 25° C., the factor 760. This number multiplied by 117 gives 88.9, which is the correct result.

This table is given on next page :

TABLE OF FACTORS CORRESPONDING TO $\frac{106}{144 - \frac{t}{2}}$

Degrees Centigrade.	*Factors.*	*Degrees Centigrade.*	*Factors.*
10°	0.719	26°	0.763
11	0.722	27	0.766
12	0.724	28	0.768
13	0.727	29	0.771
14	0.730	30	0.774
15	0.732	31	0.777
16	0.735	32	0.780
17	0.738	33	0.784
18	0.740	34	0.787
19	0.743	35	0.790
20	0.746	36	0.793
21	0.749	37	0.796
22	0.752	38	0.800
23	0.754	39	0.803
24	0.757	40	0.806
25	0.760		

XXIII.—AN APPARATUS FOR THE RAPID ANALYSIS OF MIXTURES OF GASES.

BY ARTHUR H. ELLIOTT, PH.B, F.C.S.

The apparatus is of the type of those in which the various gases are absorbed by the use of liquid reagents added in a certain order. This was carried out by Raoult* in a graduated tube with a stop-cock above and another below, and the upper stop-cock surrounded by a cylindrical funnel. But the washing out of each reagent before adding a new one, and a somewhat risky manipulation of the tube and stop-cocks to insure measuring the gas without pressure, makes this method troublesome. Wilkinson further modified this method of Raoult, by introducing another vessel in which the burette stood in water, doing away with the lower stop-cock. By this means, the level of the water in the burette, and the exterior tube, could be adjusted by means of a stop-cock on the latter, and the gas measured

*F. M. Raoult, *Compt. Rend.*, 1876, 844.

without pressure." This was an improvement over the method of Raoult, but it still left the washing out of the reagents as a drawback.

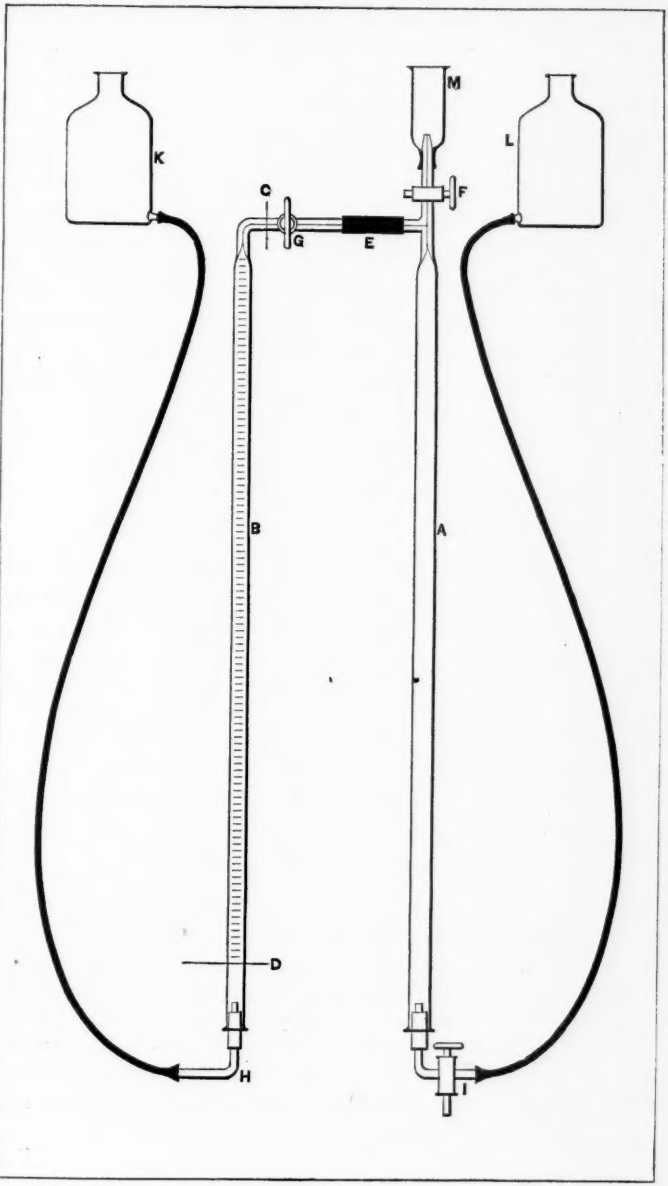
This washing becomes very important in many cases. For example, if we have a mixture of gases rich in olefient gas and ethylene, and after treating with potassic hydrate and pyrogallate of potassium, we wash out the alkali, before adding bromine to absorb the illuminants (olefient gases). The water necessary to remove this alkali, will reduce the volume of the illuminants as much as two per cent.

In the apparatus I have devised, the gas is removed from the absorbant liquid and measured in another vessel, without washing.

The apparatus is shown in the accompanying drawing. The tube A is of about 125 c.c. capacity, whilst B, although the same length, holds only 100 c.c. from the point D, or zero, to the mark on the capillary tube at C, and is carefully graduated in $\frac{1}{10}$ c.c. The attachments to these tubes below are seen from the drawing, except that the stop-cock I is three-way and has a delivery through its stern. The bottles K and L hold about 1 pint each. The tubes A and B are connected above with one another, and also with the cylindrical funnel M, by a series of capillary tubes about 1 millimeter in diameter inside. There is a stop-cock at G and another at F, whilst the funnel M, which holds about 60 c.c., is ground to fit over the end of F above. At F is a piece of rubber tubing uniting the ends of the capillary tubes, which are filed square to make them fit as close as possible.

In beginning the analysis of a mixture of gases, the stem exit of the three-way cock I is closed by turning it so that L and A are connected through the rubber tubing; the stop-cocks F and G are opened, and water is allowed to fill the apparatus from the bottles K and L, which have been previously supplied.

When the water rises in the funnel M, and all air-bubbles have been driven out of the tubes, the stop-cocks F and G are closed, the funnel M removed, and the tube delivering the gas attached in its place. By now lowering the bottle L slowly, and simultaneously opening the stop-cock F, the tube A is nearly filled with gas, and the stop-cock F is closed. The tube delivering the gas is removed, the funnel M replaced, the bottle L raised, the bottle K lowered, and by opening the stop-cock G, the gas is transferred to the graduated tube B. By placing the bottle L on a stand at about the height of the water in A, the level in B and in the bottle K can be adjusted to the


M
K
L
C
F
G
E
B
A
D
H
I

zero point, and the stop-cock G is closed. The excess of gas in A is expelled by opening the stop-cock F and raising the bottle L. The gas remaining in the capillary tube between C and the vertical part is disregarded, or its value may be ascertained and an allowance made; but usually it is too trifling to be worth notice.

Having measured the gas, it is now transferred by means of the bottles K and L into the tube A, and the fluid chemicals added by placing them in the funnel M and allowing them to flow down the sides of the tube A slowly, care being taken *never* to let the fluids run below the level of the top of the vertical tube in the funnel. It is best to have a mark on the outside of the funnel at least three-fourths of an inch above the top of the level of the vertical tube, and never draw the fluid down below this point.

Having treated the gas with the chemical, it is transferred by means of the bottles, to the tube B to be measured. If the chemical gets into the horizontal capillary tube, the passage of a little water from the bottle K will remove it, before transferring the gas. When the gas residue is in B, and the fluid of A has been adjusted at the mark C on the horizontal tube, the stop-cock G is closed, the bottle K is lowered till the level of liquid in it and in the tube B are the same, and the reading is then made. The tube A is now filled with the chemical, just used as absorbant, and water, by turning the stem of the three-way cock I, so that it communicates with A, and also opening the stop-cock F, the contents of the tube can be run out, and water run through the funnel M to clean the tube for a new absorption. When the tube is clean, by turning the stop-cock I so that A and L are connected, the water is poured into A, and the whole is ready to receive the gas in B for new treatment.

By this method a mixture containing carbonic acid, oxygen, illuminants and carbonic oxide, can be analyzed in from 20 to 30 minutes, according to the amount of practice the operator has had with the apparatus.

Compared with Orsat's apparatus, the work can be done with the above described apparatus in one-fourth the amount of time, and with identical results.

The water used in the apparatus should have the same temperature as the room in which the analysis is made; and by careful handling, little or none of the chemicals get into the bottle L. When working in a warm place, the tube B should be surrounded with a water jacket to prevent change of volume in the gas while under treatment.

School of Mines, Columbia College, N. Y.

THE AMERICAN CHEMICAL SOCIETY.

XXIV.—Proceedings.

Regular Meeting, October 7th, 1881.

The meeting was called to order at 8:20 P. M., Prof. A. R. Leeds in the chair.

The minutes of the previous meeting were read and approved.

The election of new members was then deferred till after the reading of the first paper, in order to prepare the ballots.

In the meanwhile the following gentlemen were nominated as new members:

Dr. C. W. Volney.

Proposed by { Wm. Rupp, M. Benjamin, James H. Stebbins, Jr.

Prof. R. A. Witthaus.

Proposed by { Chas. A. Doremus, Jas. H. Stebbins, Jr., Wm. Rupp.

C. E. Munsell.

Proposed by { Arthur H. Elliott, James H. Stebbins, Jr., T. O'C. Sloane.

Nelson H. Darton.

Proposed by { James H. Stebbins, Jr., T. O'C. Sloane, Arno Behr.

W. W. Share.

Proposed by { S. A. Goldschmidt, Arthur H. Elliott, James H. Stebbins, Jr.

The first paper of the evening, "On the Comparative Purity of City Water," by Dr. A. R. Leeds, was then read.

Some questions by Messrs. Endemann, Behr, Casamajor and Squibb then followed.

As the ballots were now ready, the following gentlemen were voted for, and duly elected as active members:

Albert L. Colby.

Proposed by { Arthur H. Elliott, Elwyn Waller, A. R. Leeds.

Dr. WINFIELD P. LAUVER.

Proposed by { BENJ. S. HEDRICK, P. CASAMAJOR, H. ENDEMANN.

Dr. HARRY VON BAUER.

Proposed by { H. ENDEMANN, JAMES H. STEBBINS, JR., P. CASAMAJOR.

Dr. P. RADENHAUSEN.

Proposed by { H. ENDEMANN, JAMES H. STEBBINS, JR., P. CASAMAJOR.

Dr. LOUIS HABEL.

Proposed by { H. ENDEMANN, J. P. BATTERSHALL, M. BENJAMIN.

H. C. HIEPE.

Proposed by { H. ENDEMANN, JAMES H. STEBBINS, JR., J. F. BATTERSHALL.

WM. L. LEMAN.

Proposed by { T. J. PARKER, P. CASAMAJOR, E. WALLER.

After which the second paper of the evening, "Upon some New Salts of Thymole Sulpho-acid, and some New Facts concerning the same," by JAMES H. STEBBINS, JR., S.B., was then read.

After some questions by Dr. LEEDS, the third paper of the evening. "On the Description of some New Gas Apparatus," by Dr. W. HEMPEL, then followed.

In the course of his description, samples of gas and air were analyzed, thus showing the efficiency of his instruments.

Mr. CASAMAJOR then proposed that a committee, to nominate officers for the coming year, be elected.

It was finally moved, that each person should write out the names of three candidates to serve as Nominating Committee.

This, on motion, was unanimously carried.

The following officers were then elected to serve on this committee: H. ENDEMANN, WM. GEYER, and A. R. LEEDS.

After which the meeting adjourned.

JAMES H. STEBBINS, JR.,
Recording Secretary.

Meeting of the Board of Directors.

Held Sept. 28th, at Wm. H. Nichols' Office, 41 Cedar St., N. Y.

The following Directors were present: A. R. Leeds, M. Alsberg, E. R. Squibb, W. H. Nichols, H. Endemann, James H. Stebbins, Jr.; Dr. A. R. Leeds in the chair.

The minutes of previous meeting were read and approved.

The Recording Secretary had no report.

The Treasurer then announced, that we have a balance on hand of about $400, from which we have to draw: $155.69 for printer; $25 for janitor; $60.50 for rent.

The Treasurer then moved, that the requisite amount be appropriated, with which to meet these bills.

On motion, this was unanimously carried.

The question of printing a new list of members was then brought up, and ended in the following motion by Dr. Leeds:

That if the funds permit, a list of members, combined with an index of patents, be published about the 15th of Nov., 1881, along with the Journal.

This being moved and seconded, was carried unanimously.

The Committee on Papers and Publications then stated that only 500 copies of the journal were printed the last time, leaving over about 100 extra copies. This making a difference of about $25 in the Society's favor.

Dr. Leeds then announced the following paper for the next meeting: "On the Comparative Purity of City Water," by A. R. Leeds, Ph.D.

Dr. Endemann then stated, that possibly Dr. Hempel might favor us with an exhibition of his gas apparatus.

The Committee on the Endowment Fund then stated, that a subscription of $50 extra had been made, and that total subscriptions, up to date, amount to about $8,000 or $9,000.

Deferred business: Some comment about the coming elections took place here. Mr. Nichols then moved, that this year's elections be carried on in the usual way. On motion, this was unanimously carried.

After which the meeting adjourned.

JAMES H. STEBBINS, Jr.,
Recording Secretary.

XXV.—Relative Purity of the City Waters in the United States.

By Dr. A. R. Leeds.

A legal suit has recently been instituted, which will probably have a very important bearing in the future upon the quality of water supplied to many of the principal cities in the United States. To understand more readily the nature of the questions raised in this suit, a few words of previous explanation will be requisite. The three cities of Newark, Jersey City and Hoboken, with an aggregate population of 300,000 inhabitants, all draw their water supply from the river Passaic. This is a large stream, having a daily flow at Newark of about 100,000,000 gallons. Its water-shed is mainly granitic in character, and occupies about 950 square miles in the northern part of the State of New Jersey. About three miles above the city of Newark, the Belleville pumping stations are located, and at this point the supplies of the three above-mentioned cities are taken. Some eighteen miles farther up the stream is the town of Paterson, a community almost entirely engaged in the manufacture of paper, cotton, woolen and silk goods, locomotives, etc., and which throws its entire refuse and the sewage of 50,000 inhabitants into the Passaic. Above Paterson there are few villages and factories, so that the water going over the great falls at this place is of superior quality for drinking purposes. Below Paterson manufactories are gradually springing up, and are a constant source of uneasiness and alarm to the large population using the water as pumped at Belleville. During the course of the year just past, one of these factories, an extensive paper mill, situated on the Third River, a small tributary emptying into the Passaic a short distance above Belleville, threw into the water the refuse derived from washing out some carbolized paper. The taste and odor of carbolic acid were so strong that they caused a temporary suspension of the use of the Newark, Jersey City and Hoboken water for drinking. The Newark Aqueduct Board summoned the parties to desist, which they did at the time, but afterwards repeated the offence, when suit was brought against them by the Board. In defence, the plea was entered, and an attempt made to substantiate it by the testimony of many manufacturers, that the water was already so badly polluted at Paterson that it could not be made more unfit for drinking purposes by the introduction of some carbolic acid. In fact, it was urged that, so far from being rendered

any worse from the carbolic acid, it was actually made better, for the reason that the carbolic acid served to purify and disinfect it. The case was decided in favor of the Aqueduct Board. The importance of having successfully established such a precedent can scarcely be overestimated in connection with its future influence upon the sanitary welfare of rapidly growing communities. In this category are to be placed the large cities in the Eastern and Middle States, nearly all of which are contending with one phase or another of the evils arising from the crowding in of population, and a population in many instances devoted to manufacturing, upon their source of water supply. As a consequence, the problem whether to abandon the original sources, which in most cases are those designed by nature, and to seek more distant and expensive ones, or to restrain the population by legal processes, is most urgent.

In this connection, the author has been asked by the Boards of Commissioners of Newark and Jersey City to examine into the amounts of impurities in the river Passaic, beginning with a point above Paterson, and making analyses of samples collected at an interval of a mile, until the stream has passed the city of Newark. The collection was made all upon the one day, at the close of a period of many weeks of almost unexampled drought. The analysis of the forty samples thus collected will show not only the composition of the river water, in its worst condition, but likewise the changes in that composition during a flow of twenty-one miles.

Connected with this inquiry was the important one of determining the quality of the water supply, as compared with that of other cities. The design was to collect the samples on the same day, and analyze them all by the same methods. It was but partially successful, owing to a failure to obtain simultaneous co-operation in so many places. In the case of Washington, this was due to the fact that Dr. Smith Townshend, the health officer of the district of Columbia, at the very time of receiving my telegraphic request, was summoned to attend the wounded President in the railroad station at Washington. In the great excitement and general distress, my telegram was naturally lost sight of for several days. Neither was it a mode of comparison unexceptionable in point of principle, inasmuch as the climatic conditions were not exactly the same in the various places. So that from the results gathered, it would be manifestly unfair to state that the order of purity was fixedly maintained as that given. It could only be said that at the time when the comparison was made, about the 1st of July of this year (1881), such an order existed.

	HOBOKEN.				JERSEY CITY.						PATERSON, June 23.	NEW YORK, June 23.	BROOKLYN, June 23.	BOSTON, June 23.	PHILADELPHIA, June 24.	WILMINGTON, June 24.	BALTIMORE, June 25.	WASHINGTON, July 5.	OSWEGO, July 9.	CINCINNATI, July 15.	ROCHESTER, July 23.
	I June 23.	II June 23.	III June 23.	IV June 23.	V June 23.	VI June 23.	VII June 23.	VIII June 23.	IX June 23.	X June 23.											
Free ammonia	0.002	0.0024	0.0022	0.0033	0.00475	0.00525	0.003	0.003	0.0045	0.0075	0.0025	0.0027	0.00075	0.01325	0.001	0.0035	0.005	0.006	0.0085	0.0115	0.0015
Alb. ammonia	0.0305	0.0285	0.0328	0.0290	0.0427	0.0403	0.03775	0.0293	0.0423	0.042	0.053	0.0270	0.00825	0.0605	0.018	0.0295	0.020	0.027	0.0256	0.024	0.023
Oxygen required	0.86	0.85	0.965	0.83	0.85	0.85	0.73	0.84	0.90	0.85	0.96	0.810	0.413	1.77	0.46	0.57	0.57	0.60	0.63	0.86	0.79
Nitrites	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none
Nitrates	0.6845	0.666	0.702	0.6845	0.3065	0.629	0.6845	0.666	0.702	0.7385	0.465	0.8325	1.2025	1.2395	0.6845	0.518	0.6100	0.8325	1.05	0.74	0.629
Chlorine	0.26	0.215	0.27	0.305	0.335	0.215	0.225	0.220	0.210	0.220	0.30	0.35	0.55	0.315	0.30	1.45	0.275	0.27	4.10	0.805	0.195
Total hardness	3.20	3.30	3.00	3.05	3.20	3.00	3.10	3.20	3.00	3.20	3.00	3.30	2.27	2.10	4.40	3.20	3.90	4.80	10.00	6.40	5.50
Total solids	12.20	15.60	8.50	7.40	9.30	10.80	9.70	10.00	10.80	10.50	11.70	11.80	6.00	8.50	14.30	10.00	9.40	11.50	18.07	16.20	10.00
Mineral matter	5.60	3.20	4.00	3.00	3.40	5.20	5.20	6.00	6.10	5.90	3.50	5.00	5.00	2.00	6.00	3.00	7.20	5.50	11.37	9.00	4.00
Organic and volatile matter	6.60	12.40	4.50	4.40	5.90	5.60	4.50	4.00	4.70	4.60	8.20	6.80	1.00	6.50	8.30	7.00	2.30	6.00	6.70	7.20	6.00

Together with these determinations, a number are given of the water of the river Passaic as delivered at widely different points, and at nearly the same hour, on the same day, in Jersey City and Hoboken. They show not inconsiderable differences in composition, and illustrate to what extent water may differ when flowing at very different rates of velocity, or in the case of dead ends scarcely at all, in one and the same system of distributing pipes. Nearly all these pipes were of iron, cement pipes being little used. The results given are in parts per 100,000.

The labor of making a comparison was greatly facilitated by plotting these results on a large chart, so as to form a graphic representation of them.* From this, the following order of relative purity was inferred:

I. Brooklyn.
II. Rochester.
III. Philadelphia.
IV. Baltimore.
V. Washington.
VI. New York.
VII. Newark, Jersey City, Hoboken.
VIII. Cincinnati.
IX. Oswego.
X. Wilmington, Delaware.
XI. Boston.

In many particulars the order thus arrived at was quite unforescen, and was a matter of great surprise. This was more especially true of Boston, which I anticipated would stand nearly at the head of the list, but which actually came at the bottom. And yet the water-sheds of both Brooklyn and Boston are on drift gravel. A month later I found that the best hotels in Boston, and private citizens who were willing to bear the extra expense, were supplied by spring water carted into the city, and sold at the rate of 10 cents per gallon. This state of affairs continued until the 28th of August, when I visited the city again, and inspected the Cochituate Lake and the Sudbury and Mystic Rivers, the three sources of supply. The water in the reservoirs supplied by the two latter streams had a yellow color and disagreeable, nasty taste and smell. During the earlier portion of the summer, all of the reservoirs had contained an abundant growth of algæ, which later on had decomposed, leaving

* The oxygen required to oxidize the organic matters was determined with potassium permanganate at 100° C.

behind the bad taste referred to. A striking peculiarity of these Boston waters is the large amount of decomposable organic matters held in solution. These points will best appear by examination of the results of the following analyses of samples collected on the 29th and 30th of August:

		Sudbury River.			
	Mystic Lake.	*Farm Pond.*	*First Dam.*	*Cochituate.*	*Pegan Brook.*
Free ammonia	0.015	0.001	0.012	0.025	0.289
Albuminoid ammonia	0.032	0.0325	0.039	0.064	0.240
Oxygen required to oxidize organic matters	0.900	1.180	1.190	0.830	6.630
Chlorine	3.010	0.460	0.440	0.460	7.650
Total solids	12.500	7.500	7.500	7.500	49.000
Mineral water	8.000	4.000	4.000	5.000	24.000
Organic and volatile matter	4.500	3.500	3.500	2.500	25.000

The causes of the inferior character of the Boston water supply are, first, its pollution by a few manufacturing towns, and, secondly, the growth of algæ, which again is favored by the shallow character of portions of the reservoirs and impounded streams. The worst of these sources of pollution is Pegan Brook, which flows through the town of Natick, a town of ten thousand inhabitants, almost entirely engaged in the manufacture of shoes, and empties into Cochituate Lake. The attempt has been made to mitigate the evil by throwing two filtering dams across the outlet of the stream, but both the forebays thus formed are densely overgrown with the lowest forms of aquatic vegetation, and may, to a certain extent, act as nurseries for the growth of these plants.

The Rochester water supply is derived from Hemlock Lake, remote from all sources of contamination, and after flowing through conduits for a number of miles, is discharged through a noble fountain into a reservoir near the city. A large portion of the Philadelphia supply is obtained from the river Schuylkill. At one time it was in imminent danger of fatal pollution from the growth of manufactories on the borders of the stream. But the city purchased the lands on both banks, nearly to the manufacturing town of Manyunk, located about seven miles above, and included these lands in a great park, so as to keep back all buildings from the water's edge. New York and all the places mentioned lower on the list receive their water supply from contaminated sources. The feeders which empty into Croton Lake, the principal reservoir of the New York water, pass through a settled country, with numerous tanneries, factories,

etc., along their banks. Analyses of the Croton water, made at different seasons during the past five years, have shown that it is to be classed among contaminated water supplies.

On the publication of the results above stated, it was indignantly claimed by the newspaper press of Wilmington, Delaware, that an injustice had been done to their city. But subsequently, letters published in reply by citizens of the place, have affirmed the correctness of the judgment founded on the analytical data, and have enumerated the various breweries, woolen, cotton and other mills and dye-houses, as affording a sufficient explanation of the low position assigned to the water supply.

XXVI.—Some New Facts Concerning Thymole Sulpho-acid, and some of its Salts.

By James H. Stebbins, Jr.

This work was undertaken for two reasons.

First, to establish certain facts, which thus far have either been neglected or overlooked; as for example, the production of free thymole sulpho-acid, which hitherto has only been obtained in combination with other salts. It was also my intention to produce from this latter, by direct combination, the calcium, ammonium, and soda salts, all of which have thus far not been mentioned. Or starting from, say, the barium salt, to produce by indirect combination either of the previously mentioned salts.

Second, to combine these new bodies with diazo compounds, and thus ascertain whether it is possible to produce azo compounds, from phenoles of this description.

This hypothesis seems all the more probable, as only a short time since, I obtained a yellow dye-stuff, by the direct combination of diazobenzole nitrate with an alkaline solution of thymole. As this dye was insoluble in water, the usual method of rendering such compounds soluble was resorted to, namely, the introduction of the sulpho group into the benzole nucleus.

My experiments in this line will be detailed in a subsequent paper.

The first person to engage in the study of these compounds was Lallemand,* who obtained a thymole sulpho-acid, by treating thymole with hydrochlor-sulphuric acid (SO_3HCl).

**Jahresber.* f. 1856, 617.

In 1869, A. Engelhardt and P. Latschinoff * produced three thymole sulpho-acids, by the action of sulphuric acid upon thymole, at a temperature of about 50° C. These three sulpho acids were only obtained in combination with barium, potassium, copper, lead, etc., thus making distinct, and well characterized salts, but making no attempt to produce the free sulpho acids.

It seemed, therefore, advisable to investigate this subject, and in so doing the following experiments were made:

60 grms. of thymole were treated in an evaporating dish with 50 grms. of sulphuric acid.† The dish was placed upon a steam bath, and heated for about 15 minutes.‡

The thymole soon began to dissolve, and was constantly stirred, till suddenly nearly the whole contents of the dish solidified out into a pink, crystalline mass. This mass was then drained from a clear and colorless oily fluid which impregnated the whole crystalline body.

This oily liquid solidified into a white, crystalline mass, as soon as it came in contact with the cold sides of the glass. A few isolated crystals were examined with a magnifying glass, and showed themselves to be composed of star-shaped needles. They were then labeled and set aside for further examination.

The pink crystalline mass was then dissolved in boiling water, neutralized with carbonate of calcium, and filtered hot. The sulphate of lime thus formed, besides a small quantity of unattacked thymole, were thus gotten rid of. The filtrate so obtained is nearly colorless, and was concentrated over the steam bath, till it had assumed the consistency of a syrup. On cooling, the calcium salt of alpha thymole sulpho-acid crystallized out in rhombic plates.

The solid crystalline mass so obtained was separated from the mother liquor, and dissolved at a gentle heat in 90 per cent. alcohol. The larger part of the alcohol was distilled off, and the syrup thus formed allowed to crystallize. The salt so obtained crystallizes in long white, flexible needles, bearing a strong resemblance to asbestos filaments. If a drop of the above alcoholic solution be rapidly evaporated on a watch-glass, a large number of minute star-grouped needles are obtained. These viewed under the polariscope, show a beautiful effect of circular polarized light. The phenomenon

* *Zeitschrift f. Chem.*, 1869, 43; and 615.

† The acid used was the common 66° acid.

‡ In this instance I used a higher temperature than Engelhardt and Latschinoff.

observed is a symmetrical black cross, when the nicols are crossed, with a series of concentric rings, dark, and light in monochromatic light; but, in white light, showing the prismatic colors in succession in each ring.

The cross becomes white when the nicols are in a parallel position, and each band of color in the white light changes to its complementary tint, thus making the uniaxial character of the crystal.*

The crystals so obtained were then redissolved in water, and allowed to crystallize. This salt crystallizes in two forms of rhombic plates.

The first, showing the planes mc: ∞ b: a; and mc: b: ∞ a; or macro and brachydomes.

The second, showing the planes mc: b: ∞ a, or brachydomes, and and ∞ a: b: ∞ c; or macropinacoids.

Fig. 1.

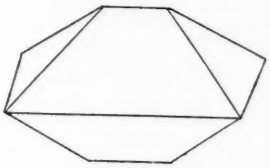
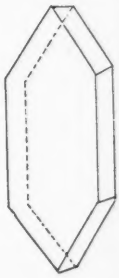


Fig. 2.



Both these crystals are the same identical compound, and constitute the calcium salt of alpha thymole sulpho-acid.

A sulphur estimation shows the correctness of this statement.

0.4246 grm. of substance yielded 0.3948 grm. $BaSO_4$, which is equivalent to :

Sulphur..... 12.77 per cent.

THEORY.

Sulphur..... 12.85 per cent.

Likewise a lime estimation gave:

Calcium ..... 9.34 per cent.

* These phenomena seem to be totally ignored by Engelhardt and Latschinoff, and I therefore look upon them as new, and worthy of a position in the literature of thymole and its substitution compounds.

THEORY.

Calcium ..... 8.32 per cent.

These figures lead us, beyond doubt, to the formula:

$$[C_6H_2(CH_3)(C_3H_7)(OH)SO_3]_2Ca + 2H_2O$$

The above compound dried at 100° C., loses two molecules of water, and falls into a fine white powder. Melting point, 156 to 157° C.

It is easily soluble in water, alcohol and ether.

MOTHER LIQUOR.

The mother liquor from the first crop of crystals was poured upon a watch-glass, and after a short time crystallized in rhombic plates, showing respectively the same form, melting point and sulphur percentage, as in the previous compound. It was, therefore, considered identical

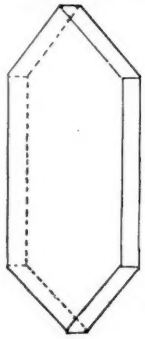
AMMONIA SALT.

A part of the Ca salt of alpha thymole sulpho-acid was next dissolved in water, heated to boiling, and decomposed by $(NH_4)_2CO_3$. The $CaCO_3$ formed was then filtered off, and the filtrate concentrated over the steam bath, to the consistency of a syrup.

The syrup so produced was then placed under the air pump, and allowed to crystallize.

After standing for a few hours, the fluid became filled with pretty, crystalline white plates. These were then drained from the mother liquor, and dried between filter paper.

The salt so obtained crystallizes in white rhombic plates, with strong vitreous lustre, and shows the planes mc: ∞ a: b; or brachydomes; and ∞ a: b: ∞ c; or macropinacoids.



At the ordinary room temperature it loses a part of its water of crystallization, and at 100° C. all the water is driven off, while the substance crumbles into a fine white powder.

1.9748 grm. of substance, on being heated to 100° C., lost 0.3794 grm. of water, which is nearly equivalent to 2 molecules.

Therefore, the ammonium salt of thymole sulpho-acid crystallizes with 2 molecules water of crystallization.

Melting point, 172 to 172.5° C.

Therefore, this salt may be represented by the following formula:

$$C_6H_2(CH_3)(C_3H_7)(SO_3.NH_4)OH + 2\ H_2O.$$

The soda salt, as well as an attempt at producing the free alpha thymole sulpho-acid, will be described in a subsequent paper.

THE AMERICAN CHEMICAL SOCIETY.

XXVII.—Proceedings.

Regular Meeting, Friday, November 4th, 1881.

The meeting was called to order at 8:40 P. M., Prof. A. R. Leeds in the chair.

The minutes of the previous meeting were read and approved.

After which the following gentlemen were elected as active members:

Dr. C. W. Volney.

Proposed by { Wm. Rupp, M. Benjamin, James H. Stebbins, Jr.

Prof. R. A. Witthaus.

Proposed by { Chas. A. Doremus, James H. Stebbins, Jr., Wm. Rupp.

C. E. Munsell.

Proposed by { A. H. Elliott, James H. Stebbins, Jr., T. O'C. Sloane.

Nelson H. Darton.

Proposed by { James H. Stebbins, Jr., T. O'C. Sloane, Arno Behr.

W. W. Share.

Proposed by { S. A. Goldschmidt, A. H. Elliott, James H. Stebbins, Jr.

Thos. D. O'Connor.

Proposed by { T. O'C. Sloane, P. Casamajor, James H. Stebbins, Jr.

As there were no new members to nominate, the next in order was the report from the Nominating Committee.

This had to be deferred, however, as the chairman of said committee was absent.

The Recording Secretary then announced the resignation of Dr. WILEY, which, on motion, was duly accepted.

The Secretary then announced the death of Mr. CHAS. SCHMICH, who died last March of pneumonia.

It was then moved that Mr. SCHMICH's death be duly entered on the minutes. This being seconded, was carried unanimously.

After which the first paper of the evening, "On some New Salts of Alpha Thymole Sulpho-acid, and some New Facts concerning the same," by JAMES H. STEBBINS, JR., S.B., was then read.

After some questions by Mr. ELLIOTT, the second paper, "On the Combination of Diazo Compounds with Thymole Sulpho-acid," by JAMES H. STEBBINS, JR., S.B., then followed.

After some questions by Messrs. ELLIOTT and FRIEDBURG, the third paper, "On the Constitution of the Explosive Derivatives of Glycerine," by Dr. VOLNEY, was then read.

Some criticisms and remarks by Dr. FRIEDBURG and others then followed.

The report of the Nominating Committee was now ready, and the following gentlemen were nominated as candidates for the coming election:

Corresponding Secretary:

P. CASAMAJOR.

Recording Secretary:

JAMES H. STEBBINS, JR.

Librarian:

GEO. PROCHAZKA.

Curators:

ROSSI, FESQUET, RUPP.

Committee on Papers and Publications:

ARNO BEHR, A. R. LEDOUX and H. ENDEMANN.

Committee on Nominations:

ARTHUR H. ELLIOTT, J. P. BATTERSHALL,
O. H. KRAUSE, J. B. F. HERRESHOFF,
T. O'C. SLOANE.

Directors:

P. CASAMAJOR,	JAMES H. STEBBINS, JR.,	H. MORTON,
C. F. CHANDLER,	M. ALSBERG,	E. R. SQUIBB,
W. H. NICHOLS,	W. M. HABIRSHAW,	ELWYN WALLER,
H. ENDEMANN,	A. R. GALLATIN,	GEO. PROCHAZKA,
	A. R. LEEDS.	

As the Chairman was obliged to depart before the close of meeting, Mr. CASAMAJOR was elected Chairman *pro tem.*

The meeting was then adjourned.

JAMES H. STEBBINS, JR.,
Recording Secretary.

XXVIII.—ON SOME NEW SALTS OF ALPHA THYMOLE SULPHO-ACID, AND SOME NEW FACTS CONCERNING THE SAME.

(Second Paper.)

BY JAMES H. STEBBINS, JR.

In my last paper I described the calcium and ammonium salts of alpha thymole sulpho-acid. In this paper I will describe the sodium salt and free sulpho acid, which I mentioned in connection with my first paper.

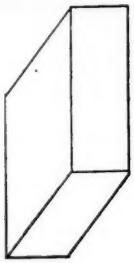
Soda salt of alpha thymole sulpho-acid,

$$C_6H_2(CH_3)(C_3H_7)(NaSO_3)ONa + 2\tfrac{1}{2}H_2O.$$

A part of the lime salt was dissolved in boiling water and decomposed with Na_2CO_3.

The $CaCO_3$ thus formed was then filtered off, and the clear filtrate concentrated over the steam bath to the consistency of a syrup. On cooling, the soda salt crystallized in fine white, rhombic plates, with strong vitreous lustre. These crystals show the planes, a: ∞c: ∞b, or macropinacoids; and ∞c : b : ∞ a, or macrodomes.

The crystalline form may be seen from the following diagram:



This compound is easily soluble in water and alcohol; melting point, 166 to 167° C. At 100° C., it parts with all its water of crystallization, and crumbles into a fine white powder, in the same manner as the other salts described.

Alpha thymole sulpho-acid:

$$C_6H_2(CH_3)(C_3H_7)(HSO_3)OH + H_2O.$$

It was first tried to obtain this body by decomposing the lime salt with CO_2; however, this failed completely, as even a prolonged passing of CO_2 through a concentrated solution of the lime salt failed to produce the slightest precipitate of carbonate of lime. Therefore, this was abandoned, and the lead salt was resorted to, as the best means of accomplishing this end. 60 grms. of thymole were dissolved in 50 grms. of H_2SO_4, and heated on the steam bath till the contents of the dish became nearly one crystallized mass. The colorless fluid * remaining was poured off, and the pink crystalline body dissolved in boiling water, and was then neutralized with carbonate of lead. The lead sulphate formed was filtered off, and a current of H_2S was then passed through the clear filtrate, till all the lead (in combination with thymole sulpho-acid) had been precipitated as black sulphide of lead. This was then collected on a filter, and the filtrate evaporated to the consistency of a syrup. When cold, the free sulpho acid crystallized in beautiful, large white rhombic scales, with pearly lustre and greasy feel.

It dissolves very readily in hot and cold water; melting point, 91 to 92° C.

This body, in crystallizing, retains a certain amount of water, with which it parts, however, if placed for a few days over sulphuric acid.

A water estimation of substance dried over sulphuric acid gave: 1.052 grm. substance lost 0.15 grm. of water, or equivalent to very nearly one molecule.

Heated on platinum foil, the salt first melts and then burns with a sooty red flame, leaving a voluminous black carbon residue behind.

A carbon and hydrogen estimation of the above gave:

	THEORY.		
C_{10}	120	52.17	per cent.
H_{14}	14	6.08	"
S	32	13.91	"
O_4	64	27.84	"
	230	100.00	

* This fluid is the same as mentioned in my first, as a by-product in the preparation of alpha thymole sulpho-acid.

FOUND.

Carbon	52.19 per cent.
Hydrogen	6.10 "

BY-PRODUCT.

The by-product heretofore described was dissolved in boiling water, and neutralized with $PbCO_3$.

The precipitate of $PbSO_4$ was collected on a filter, and the clear filtrate treated with a current of H_2S, till all the lead had been thrown down as PbS. This was collected on a filter, and the filtrate evaporated to the consistency of a syrup. It was then placed over sulphuric acid and allowed to crystallize. The compound so obtained crystallizes in long, white needles, which bear a striking resemblance to the disulpho acid of alpha thymole. They are very easily soluble in water, and are likewise quite hygroscopic.

Owing to the small amount of substance under examination, a combustion was out of question, but to judge from the appearance of this body, I should immediately call it alpha thymole disulpho-acid.

XXIX.—On the Combination of Diazo Compounds with Alpha Thymole Sulpho-acid.

By James H. Stebbins, Jr.

In my last paper I hinted at the possibility of combining diazo compounds with alpha thymole sulpho-acid, and I will take the liberty, on this occasion, of describing my experiments in this direction.

Azobenzole alpha thymole sulpho-acid,

$$C_6H_4 - N = N - C_6H(CH_3)(C_3H_7)(HSO_3)OH.$$

9.3 grms. aniline were dissolved in 22 grms. of strong HCl, diluted with 200 c.c. of water. To this mixture was then added, under constant stirring, 7 grms. of $NaNO_2$, previously dissolved in 50 c.c. of water.

The diazobenzole chloride thus formed was added gradually to an alkaline solution of the soda salt of alpha thymole sulpho-acid, consisting of 23.6 grms. of the sulpho acid and 8 grms. of KOH, previously dissolved in 200 c.c. of water. A copious yellow precipitate, composed of minute hair-fine needles, is thus formed, and constitutes the soda salt of our new dye-stuff.

This was then dissolved in boiling water and filtered from a black tarry fluid which was formed during the dissolving process. This

tarry fluid solidifies on cooling into a black mass, and evidently indicates that a decomposition of some kind had taken place.

The clear filtrate, when cold, deposits the soda salt of our new substance in the form of a network of minute, hair-fine, yellow needles. They were then collected on a filter, washed and dried at 100° C. When dry they take on a fine, metallic golden lustre, but their yellow color is changed to red-brown by the action of heat, which, however, does not destroy their tinctorial properties. This salt is easily soluble in water, and alcohol, and dyes wool of a pretty yellow color, in an acid bath. The formation of this substance may be explained, theoretically speaking, as follows:

$$C_6H_5N_2Cl + C_6H_2(CH_3)(C_3H_7)(NaSO_3)ONa =$$
$$C_6H_5 - N = N - C_6H(CH_3)(C_3H_7)(NaSO_3)OH) + (NaCl.$$

A combustion of the above gave:

THEORY.

C_{16}	192	53.93	per cent.
H_{17}	17	4.77	"
N_2	28	7.86	"
S	32	8.99	"
Na	23	6.46	"
O_4	64	17.99	"
	356	100.00	

FOUND.

Carbon	53.77	per cent.
Hydrogen	4.72	"
Nitrogen	8.71	"

A sulphur estimation gave: 0.2060 grm. substance gave 0.1350 grm. $BaSO_4$, which is equal to sulphur 8.99 per cent.

BARIUM SALT.

$$[C_6H_5 - N = N - C_6H(CH_3)(C_3H_7)\begin{matrix}(SO_3)\\(OH)\end{matrix}] 2Ba$$

A part of the soda salt was dissolved in boiling water, and treated with an excess of $BaCl_2$. This threw down the barium salt as an amorphous yellow precipitate. This was collected on a filter, washed several times, and then treated with boiling water.

As soon as the fluid cools, the barium salt crystallizes in hair-fine yellow needles. These are insoluble in cold, and only sparingly soluble in boiling water, but quite soluble in 90 per cent. alcohol.

A barium estimate was made, in order to ascertain the true molecular weight of the free acid, as well as to verify the assumed formula of the barium salt. 0.0902 grm. of substance gave 0.0238 grm. ash, or :

Barium ..... 18.35 per cent.

THEORY.

Barium ..... 18.40 per cent.

This proves, beyond doubt, the correctness of the formula above set forth.

FREE ACID.

$$C_6H_5 - N = N - C_6H(CH_3)(C_3H_7)(HSO_3)OH.$$

A portion of the soda salt was dissolved in boiling water, and treated with an excess of strong HCl.

This threw down the free acid as a red amorphous precipitate, which, when dry, has a beautiful, golden-red, metallic lustre. The precipitate was then collected on a filter, and dissolved in boiling water. The hot solution so obtained was filtered, to separate it from a black resinous substance which seemed to be formed by the decomposition of the free acid while boiling with water. The filtrate, when cold, deposited the free dye-stuff, in the form of minute yellow, six-sided prisms. This body melts at 215¾° C., with total decomposition. When heated on platinum foil, it burns with a red flame, and evolves copious yellow fumes, while on the foil is left a very difficultly combustible carbon residue. This interesting new dye-stuff, although of no commercial value, fully sustains the theory that we advanced in the beginning of this paper, namely, that diazo compounds can be made to combine with phenoles of the kind referred to.

The constitution of this compound can be explained from its reduction products. When treated with reducing agents, as zinc dust, or tin and HCl, the solution is decolorized, probably forming aniline, and amido thymole sulpho-acid. This latter, however, I have failed to isolate, as the quantity of material under examination was too small.

Parazotoluole alpha thymole sulpho-acid.

$$C_6H_4(\overset{4}{C}H_3) - \overset{1}{N} = N - C_6H(CH_3)(C_3H_7)(HSO_3)OH.$$

10.8 grms. of paratoluidine were dissolved in 22 grms. of strong HCl, diluted with 200 c.c. of water.

To this was then added, under constant stirring, 7 grms. of $NaNO_2$, previously dissolved in 50 c.c. of water.

The paradiazotoluole chloride thus formed, was allowed to rest for a while, and then mixed with 23.6 grms. of the soda salt of

alpha thymole sulpho-acid, previously dissolved in 200 c.c. of water, made alkaline with 8 grms. of NaOH.

A copious yellow precipitate of the soda salt of parazotoluole alpha thymole sulpho-acid is formed. This was then collected on a filter, washed and dissolved in boiling water.

This compound is partially decomposed by boiling water, in the same manner as the previously described body.

The filtrate of the above when cold, deposits the soda salt in hair-fine, yellow-brown needles.

It is nearly insoluble in cold, but more soluble in boiling water.

It melts far above the boiling point of strong H_2SO_4.

The formation of this substance may be explained from the following reaction.

$$C_6H_4(CH_3)NCl + C_6H_2(CH_3)(C_3H_7)(NaSO_3)ONa =$$

$$C_6H_4(\overset{4}{C}H_3) - \overset{:}{N} = \overset{1}{N} - C_6H(CN_3)(C_3H_7)(NaSO_3)OH + NaCl.$$

This compound is of particular interest, as it proves beyond a doubt that diazo compounds, derived from the higher homologues of aniline, can be combined in the same way as diazobenzole, with thymole sulpho-acid, to form compound azo dye-stuffs.

From the foregoing we might naturally be led to expect that diazo-xylole and diazo-naphthalene can, in like manner, be combined with alpha thymole sulpho-acid. The verification of this assumption will be detailed in the following experiment :

Azoxylole alpha thymole sulpho-acid,

$$C_6H_3(CH_3)_2 - N = N - C_6H(CH_3)(C_3H_7)(HSO_3)OH.$$

This compound is produced by dissolving 6.1 grms. of xylidine in 11 grms. of strong HCl, diluted with 100 c.c. of water. To this is then added, under constant stirring, 4.2 grms. of KNO_2, previously dissolved in 50 c.c. of water.

The diazo-xylole chloride thus formed is poured, little by little, into a solution consisting of 17.3 grms. of the soda salt of alpha thymole sulpho-acid, dissolved in 100 c.c. of water, rendered alkaline with 4 grms. of KOH.

A copious brown precipitate of the soda salt is thus formed. This was then collected on a filter, washed several times, and then dissolved in boiling water. The solution so obtained was then filtered, in order to separate it from a tarry residue which was formed while dissolving with boiling water. The filtrate, when cold, coagulates into a thick, slimy mixture, and as this failed to crystallize, one-half of it was then treated with a concentrated solution of $BaCl_2$.

This immediately threw down a copious, yellow-brown precipitate of the barium salt. It was then washed several times with water, in order to remove all traces of $BaCl_2$, and then dissolved in boiling alcohol, and allowed to cool.

BARIUM SALT.

$$[C_6H_3(CH_3)_2 - N = N - C_6H(CH_3)(C_3H_7)(OH)SO_3]_2Ba.$$

This salt is obtained, as already described, from the soda salt, by treating with $BaCl_2$.

It is insoluble in cold, and very nearly insoluble in boiling water. It is, however, quite soluble in hot 90 per cent. alcohol, from which it crystallizes in two forms. By rapid evaporation of the hot alcoholic solution, the barium salt is deposited, as a network of hair-fine, yellow needles. By slow evaporation, on the contrary, pretty lemon-yellow leaflets are obtained.

This salt should contain the following percentage of barium :

THEORY.

Barium..... ...15.92 per cent.

FOUND.

Barium.....15.42 per cent.

FREE ACID.

$$C_6H_3(CH_3)_2 - N = N - C_6H(CH_3)(C_3H_7)(HSO_3)OH.$$

This compound was obtained by treating the second half of the slimy soda salt with an excess of strong HCl, which threw it down as a copious red-brown precipitate.

This was then collected on a filter, and washed with cold water till the excess of HCl had been removed, and was then treated with boiling water, in which it is but sparingly soluble.

The hot solution was then filtered, in order to separate it from a tarry residue, and the filtrate allowed to cool. When cold, the free acid separates out in little, yellow, hair-fine needles, which were cooled on a filter, washed and dried.

Boiling water acts upon this compound in the same manner as the two previously described bodies ; that is, there is partial decomposition, with evolution of gas bubbles (probably nitrogen), and formation of a tarry residue which smells very much like xylenole.

Therefore, from what we have seen, the unstability of these compounds might lead us to assume that the azo radical (— N = N —) is only very loosely bound to the benzole nucleus in thymole sulpho-acid, and that, consequently, the mere boiling with water is

sufficient to loosen the bonds between them, at the same time giving off nitrogen, and forming the corresponding phenole.

Should this be the case, the decomposition referred to might be expressed as follows:

$$C_6H_3(CH_3)_2 - N = N - C_6H(CH_3)(C_3H_7)(HSO_3)OH) + (H_2O = C_6H_3(CH_3)_2OH + C_6H_2(CH_3)(C_3H_7)(HSO_3)OH) + (N_2.$$

Compounds of this nature might be looked upon as belonging to the diazo group; but, even were this assumed, I hardly think that the mere splitting up of the molecule (as above indicated) in these substances, is sufficient proof to classify them among the diazo compounds.

Diazo compounds are, as is well known, subject to a large number of transformations, of which the above reaction is one. But setting this one aside, I cannot find among my new substances any other characterizing features which should justify me in putting them under the head of diazo compounds; and I must, therefore, look upon them as highly unstable compound azo bodies.

It will likewise be observed here, that the solubility of these substances decreases as the molecular weight rises, a fact which might have a tendency to explain their increased unstability.

Another curious fact may be mentioned here, namely, that these substances have all the same yellow shade of color, whereas the dyestuffs derived from phenole and naphthole usually increase in depth of shade as the molecular weight rises.

For the above reason it was, therefore, not considered worth the while to try the action of diazonaphthalene on thymole sulpho-acid, as it might be supposed that the compound resulting from such a reaction would be too unstable to investigate, or that there might be no compound found whatsoever.

Therefore, to sum up, it will be seen that thymole sulpho-acid can be combined with diazo compounds, but that the resulting substances increase in unstability as their molecular weight rises.

THE AMERICAN CHEMICAL SOCIETY.

XXX.—Proceedings.

Annual Meeting, Friday, Dec. 2, 1881.

The meeting was called to order at 8:40 P. M., Prof. A. R. Leeds in the chair.

The minutes of the previous meeting were read, and after correction, were approved.

The President had no report.

The Board of Directors had no report.

The Treasurer reports that we had a balance on hand at last annual report of $342.62; received for dues, etc., for 1881, $1,262.95; total, $1,605.57; expenditures for 1881, $1,270.31, thus leaving a balance on hand of $335.26. From this, however, several due bills are to be paid, which, when paid, would leave in the treasury about $275. On motion, the Treasurer's report was duly accepted.

The Librarian then stated that some books needed binding. The report was duly accepted.

The Curators then reported that the Society had been presented with a fine microscope.

Dr. Leeds then stated on behalf of the Committee on the Endowment Fund, that the fund is progressing slowly. He mentioned a new contribution of $50, and stated that the Fund is now approaching the sum of $10,000.

After which the election of officers and committees was in order.

Dr. Squibb here stated his desire to have his name withdrawn from the list of Vice-Presidents.

After some remarks by Messrs. Casamajor and Nichols, his withdrawal was accepted with regret.

After which the Chair appointed Messrs. Casamajor and Grothe to act as tellers in collecting the ballot. The following gentlemen were voted for

For President.

Profs. MORTON and MALLET having received the largest number of votes, it became necessary to elect one of these gentlemen, as there was not a majority of votes in either case.

Dr. SQUIBB moved that the Secretary cast an affirmative ballot for Prof. MALLET. This being seconded, was carried unanimously.

The Secretary then cast an affirmative ballot, thus electing Prof. J. W. MALLET as President.

For Vice-Presidents.

Mr. NICHOLS then moved that the tellers cast an affirmative ballot for the candidates having the largest number of votes.

It was then amended to lay this on the table. On motion, this was unanimously carried.

After which Mr. NICHOLS moved that his first motion be accepted. Duly carried.

The tellers then cast an affirmative vote for Messrs. LEEDS, WALLER, PRESCOTT, HABIRSHAW, GOESSMAN and LUPTON.

The rest of the ticket was duly elected.

After which Dr. ALSBERG stated his desire to resign. Some remarks and nominations by Messrs. NICHOLS, ELLIOTT and GEYER then followed, after which Dr. ALSBERG's resignation was accepted.

Mr. BENJAMIN then nominated Dr. SLOANE as Treasurer. It was moved that the tellers should cast an affirmative vote for Dr. SLOANE. This being seconded, was duly carried.

The tellers then declared Dr. SLOANE elected. Mr. BENJAMIN then nominated Mr. HALLOCK to take Dr. SLOANE's place on the Committee of Nominations. This was carried by acclamation.

It here became necessary to elect three more Directors, to fill vacancies caused by resignations.

The following gentlemen were then nominated: Messrs. MOORE, EIMER, RICKETTS, GEYER and HERRESHOFF.

It was here moved that the nominations be closed. Carried unanimously.

Dr. SQUIBB then moved that the meeting be adjourned till the second Friday of the month, in order that the papers announced might be read. On motion, this was duly carried.

Mr. ELLIOTT then mentioned the sudden death of Dr. JOHN LIPPS, and stated that only $7 were found on his person, and with $300 debts.

Mr. ELLIOTT then moved that a committee of four be appointed to look after and collect the necessary funds for his burial.

This motion was duly carried.

Mr. NICHOLS then made the following amendment: That Mr. ELLIOTT be appointed as a committee of one, and that he have power to add to his list at discretion. Carried.

The tellers then announced that Messrs. RICKETTS, HERRESHOFF and GEYER had been elected as Directors.

After which the meeting adjourned.

The total list of officers for 1882 is as follows:

President,

Prof. J. W. MALLET.

Vice-Presidents,

A. R. LEEDS, W. M. HABIRSHAW,
E. WALLER, CHAS. A. GOESSMAN,
A. B. PRESCOTT, N. T. LUPTON.

Corresponding Secretary,

P. CASAMAJOR.

Recording Secretary,

JAMES H. STEBBINS, JR.

Treasurer,

T. O'C. SLOANE.

Librarian,

GEO. PROCHAZKA.

Curators,

A. G. ROSSI, WM. RUPP, A. A. FESQUET.

Committee on Papers and Publications,

ARNO BEHR, A. R. LEDOUX, H. ENDEMANN.

Committee on Nominations,

ARTHUR H. ELLIOTT, J. P. BATTERSHALL,
O. H. KRAUSE, J. B. F. HERRESHOFF,
A. E. HALLOCK.

Directors,

A. R. LEEDS,
E. WALLER,
JAMES H. STEBBINS, JR.,
GEO. A. PROCHAZKA,
C. F. CHANDLER,
J. B. F. HERRESHOFF,
W. M. HABIRSHAW,
P. CASAMAJOR,
T. O'C. SLOANE,
H. ENDEMANN,
W. E. GEYER,
H. MORTON,
P. DE P. RICKETTS.

JAMES H. STEBBINS, JR.,
Recording Secretary.

REPORT OF THE COMMITTEE ON THE ENDOWMENT FUND.

For the information of the members not intimately conversant with the business difficulties with which the foundation, in this country, of a national organization of chemists has been attended, it should be stated that the proposition to endow the publications of the Society, grew out of the great burden entailed by the attempt to publish a journal at frequent intervals. The design in so doing was to afford to all of the members an opportunity for the prompt publication of their original researches, and, in addition, with the aid of a corps of abstractors, to supply a summary of the most valuable matters published abroad. This entailed a great deal of labor upon the Editor and other members of the Publication Committee, and upon the gentlemen who assisted them. It resulted in a handsome volume of 621 pages for the year 1879, and a volume of 480 pages for the year 1880. That the volume for the past year has been of less size, has been due to the fact that the Society has not had sufficient money to pay for a larger one. But it has continued the JOURNAL with all the resources at its disposal, and will continue to do so, avoiding at the same time incurring any debt.

To make this JOURNAL as honorable and useful to the profession in this country as possible, and as it should be to comport with the dignity of a national organization of chemists, a larger annual income than that afforded by the annual dues, is imperatively necessary. The appeal has met with a favorable response from most of the manufacturing chemists thus far applied to, and we doubt not that the sum required could be speedily raised if the wants of the Society were made known to all. An endowment fund of this char-

acter, would guarantee the perpetuity of the publication of the JOURNAL and the Society itself, and though the past year has been one in which but a very limited amount of matter could be published, for the reason above given, success in procuring the moderate sum still required to complete the endowment, would usher in a period of far greater prosperity and usefulness than the Society has as yet enjoyed. The list of the subscribers is given below:

LIST OF SUBSCRIBERS TO THE ENDOWMENT FUND OF $15,000 OF THE AMERICAN CHEMICAL SOCIETY.

The interest of this sum, it is thought, will cover the annual deficit arising from the expenses connected with the Publication of the Society. The collection of the amounts subscribed, is contingent upon the raising of the entire sum.

HAVEMEYER & ELDER		$1,000 00
MATTHIESEN & WIECHERS		500 00
HELLER & MERZ		200 00
JOHN M. MAISCH		50 00
WM. H. NICHOLS		500 00
E. WALLER		100 00
E. R. SQUIBB		100 00
P. CASAMAJOR		100 00
A. R. LEEDS		100 00
JAS. H. STEBBINS, JR		50 00
C. F. CHANDLER		200 00
HENRY MORTON		100 00
PICKHARDT & KUTTROFF		500 00
Subscription at Anniversary Meeting, 1880.		
M. ALSBERG	$25 00	
GEO. A. PROCHAZKA	10 00	
A. H. KRAUSE	10 00	
GIDEON E. MOORE	10 00	
H. N. VAUGHAN	10 00	65 00
SANITARY ENGINEER		50 00
TESSIÈ DU MOTAY		200 00
J. GOLDMARK		100 00
WM. WEIGHTMAN		500 00
ROSENGARTEN & SONS		100 00
HARRISON, HAVEMEYER & CO.		100 00
MARTIN KALBFLEISCH'S SONS		500 00

Jas. Morgan & Co.....	500 00
McKesson & Robbins.....	250 00
W. H. Schieffelin & Co.....	100 00
H. S. Deshon.....	50 00
J. L. & D. S. Riker.....	100 00
Dodge & Olcott.....	100 00
B. F. Leeds.....	50 00
Pfizer & Co.....	500 00
A. A. Fesquet.....	100 00
Hector C. Havemeyer.....	300 00
Eimer & Amend.....	100 00
Whitall & Tatum.....	100 00
Henry Bower.....	100 00
Harrison Bros. & Co.....	100 00
Elmore & Richards.....	100 00
Manufacturing Chemists Association of the United States, through Henry Bower, Esq., Secretary.....	400 00

Note.—The Association likewise donated $100 for the immediate needs of the Publication Committee of the Society.

F. W. Devoe & Co..... ..	100 00
Martin E. Waldstein.....	50 00
W. M. Habirshaw	100 00
Edward Hill.....	100 00
Lanman & Kemp.....	100 00
Peter Cooper's Glue Factory	100 00
H. J. Baker & Bro.....	100 00
A. B. Ansbacher.....	50 00
D. F. Tieman & Co.....	100 00
Waldron Shapleigh.....	25 00
	$8790 00

Albert R. Leeds,
John M. Maisch,
James H. Stebbins, Jr.,
Committee on Endowment Fund.

XXXI.—On a Modification of Mohr's Burette Adapting it for Use in Measuring Corrosive Solutions, etc.

By Nelson H. Darton.

All who have frequent occasion to use the burette well know that the form contrived by F. Mohr is pre-eminently the most convenient, and that solutions may be delivered from it with less care, and, as I have found in a somewhat extended experience, greater accuracy than any other form. But as the solution of that much used reagent, permanganate of potassa, and some others, speedily destroys and is contaminated by the caoutchouc tubing attached, an instrument is required which will readily deliver the solution without having to come in contact with any organic bodies (this also applies to the delivery pipette). To accomplish this end, the Gay Lussac, Geisler, and Beck's burettes have been suggested, and extensively employed, but to me, at least, they have never given entire satisfaction. As I have had to use the burette so extensively myself, all the technical processes of my laboratory being executed by volumetric analysis, and I am now writing a work on that subject, that I perhaps have felt the need of a proper instrument more than the majority of dentists. So to obviate the difficulties in the above burettes, I have contrived a form which I have termed a modification, and after using it for some time with the most satisfactory results, I have come to the conclusion that it is perfect in all its applications. The following is a cut and description of this useful instrument:

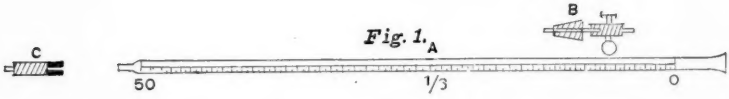


Fig. 1.

The body, graduated as in the other forms, is drawn out and ground underneath to a perfectly plane surface, having the fine orifice in the centre; the stem should be about 15 m.m. long. While filling from above, holding a solution more than a half hour, etc., a small stopper *c* is used. It consists of a small piece of caoutchouc tubing, sufficiently large to fit over the stem tightly, and bearing a piece of glass bar half-way up its length, the upper end of which is ground to correspond with the under surface of the stem; this, when adjusted, forms an air-tight connection. The other end of the instrument is flared to receive a stopper, through which passes a glass

tube bearing a rubber tube, and pinch-cock, which is used to control the access of air through a small glass jet attached, thus allowing the solution to run out as required. The pipette is similarly constructed. The rubber tube connection shown in the cut as 5 c.m. long, is in practice as long as the burette, and the cock is thus placed at the hand of the operator as he is seated. In filling the burette, the jet is attached to the tube from the aspirator, the cork above the jet is opened, and a beaker full, or the required amount of solution in a beaker, placed under the stem; the aspirator cock is opened for a sufficient length of time, and the burette thus filled. In a very fine orifice burette, we may use two pinch-cocks, 5 c.m. or so apart, to control the access of air.

XXXII.—New Filtering Apparatus.

By P. Casamajor.

In the year 1875,* I published descriptions of two funnels for filtering under pressure, one of which was to be applied to the method of filtration proposed by Dr. H. Carmichael, and described in the "Select Method of Chemical Analysis," of Mr. William Crooper (p. 429). In this method, the liquid is separated from the precipitate by the agency of a small disk of filtering paper, held against the perforated surface of a vessel, the interior of which communicates with an aspirator. This vessel, having the paper disk held against it, is placed directly in a platinum or porclain dish, in which the precipitate is to be afterwards heated.

Dr. Carmichael made his vessel, communicating with the aspirator, of glass, but his method for making perforations on the flat side of this vessel was, to say the least, so very difficult, that very few chemists had succeeded in applying his method of filtration. The funnel which I used for the purpose, was of glass, the shape being that of a Platner's blow-pipe mouth-piece. The mouth of the funnel was closed by a small disk of filter paper, resting on a perforated platinum plate. This plate was also circular and slightly smaller than the disk of filtering paper. Both the perforated plate and disk of filter paper were held tightly against the funnel by the suction of an aspirator.

In the same paper there is a description of another funnel, to be used with the same filter, but, in using this funnel, whose shape is

* *American Chemist*, **5**, 440, and *Chemical News*, **32**, 46.

that of a large thistle tube, the perforated platinum plate is placed on the bottom of the funnel, and, over it, the small disk of filter paper, the edges of which slightly overlap those of the perforated plate. The liquid to be filtered is poured in the funnel. With this funnel, any ordinary aspirator may be used, but I have always used, in connection with it, a simple aspirator consisting of a straight vertical tube of small diameter, attached to the bottom of the funnel. I again called attention to this particular form of aspirator in a subsequent paper,* published shortly after, in which are given fuller details as to its use.

The vertical tube acts by the weight of the column of water, which it holds suspended below the liquid. Its use was made possible by the fact that, when there was no more liquid above the moist disk of filter paper, this became impervious to air, and the column of liquid in the vertical tube continued to be held in suspension, but any additional liquid poured in the funnel went through the paper disk without any difficulty.

I pointed out that, instead of using a disk of filter paper, paper pulp or asbestos pulp could be poured into the funnel. The excess of water would run out, and a layer of paper or of asbestos would be left on top of the perforated plate, and around its edges, and form a very efficient filtering medium.

This aspirator, consisting of a vertical tube, was found so simple and convenient, that I tried to apply it to the funnel first described, which is used in Dr. Carmichael's system of filtration, but the experiments were not successful. In funnels of this shape, the perforated plate and disk of filter paper are held on the under side of the funnel by the suction of an aspirator. Whenever the aspirator ceases to act, the platinum plate and sheet of paper drop down.

The difficulty experienced was due to this: that the paper filter cannot be held in position unless there is a volume of liquid in the vertical tube, while, at the same time, the vertical tube cannot be filled unless the paper filter is held tightly against the funnel.

These are the antecedents of the filter and the aspirator which I now propose to describe.

In this new filtering apparatus, the filtering medium is laid on a perforated plate, provided with a tube open at both ends, which is

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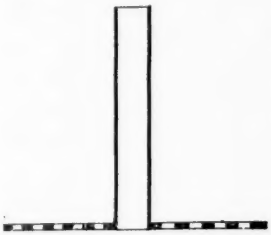
* Funnels with auxiliary vertical tube; see *American Chemist*, **6**, 124, and *Chemical News*, **32**, 184.

firmly attached to the plate, over a hole of the same size as the tube. Figure 1 shows a section of the plate, with the tube attached.

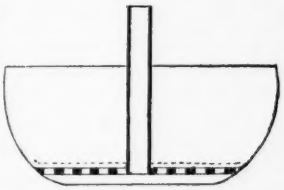
Fig. 1.



This perforated plate is laid on the bottom of a dish or crucible made of platinum, porcelain, or any other suitable material. The upper portion of the tube is connected with an aspirator, and there must be a small space left between the under surface of the plate and the bottom of the vessel, to allow the filtered liquid to pass through the filtering medium. The liquid which passes into the space under the plate, is removed through the tube by the action of the aspirator.

Figure 2 shows the perforated plate in position at the bottom of a platinum or porcelain dish. The filtering medium rests on top of the perforated plate, and is indicated by a fine dotted line. If the bottom of the vessel should be perfectly flat, it would be necessary to make the perforated plate slightly curved, with the concavity turned downward, to allow a space between the plate and the bottom of the vessel.

Fig. 2.



The filtering medium may be a piece of filter paper, or it may be deposited in the form of paper pulp or asbestos pulp, as already mentioned. If a paper filter is used, there should be a hole in it, to let the tube go through. The perforations in the plate should begin at a certain distance from the tube, so that every portion of the perforated surface may be covered with paper.

It is a very simple matter to make this perforated plate with its tube. Any jeweler can make a tube from platinum foil, and solder the joint with coin gold, which is sufficiently infusible for most purposes, and the tube can be soldered to the plate with the same material. This is the readiest way, and it is next to impossible in this country to have work of this kind done entirely of platinum.

We may also form this piece of apparatus in two portions. Any metal-spinner can turn, on a platinum plate, a tube 5 or 6 millimeters long, and, over this short tube, a platinum tube about 3 centimeters long, can be firmly placed. It is very important that the long plati-

num tube should come down as low as possible over the shorter tube, so that the pulp of paper or asbestos, may be deposited over the joint.

It is almost useless to mention that the weight of the perforated plate should be taken as part of the tare, with the weight of the platinum vessel, and of the asbestos, when a pulp of this material is used. The perforated plate remains in the crucible or dish, while the precipitate is heated, and it is afterward placed on the balance along with the precipitate. When asbestos is used, the requisite quantity should be placed in the vessel in which the precipitate is to be heated, the perforated plate should be added, and the whole sufficiently heated. The vessel and all the contents should then be placed on the balance, so as to obtain the total tare. If the platinum tube is not soldered to the perforated plate, it may with great convenience be left out of the count, as it may be easily removed by holding down the perforated plate with a spatula, and pulling off the tubes after the filtration is over. The quantity of asbestos required is very slight. Dry asbestos, weighing 1 decigram, if sufficiently fine, can easily cover a perforated plate with a surface of 6 square centimeters (about 1 square inch).

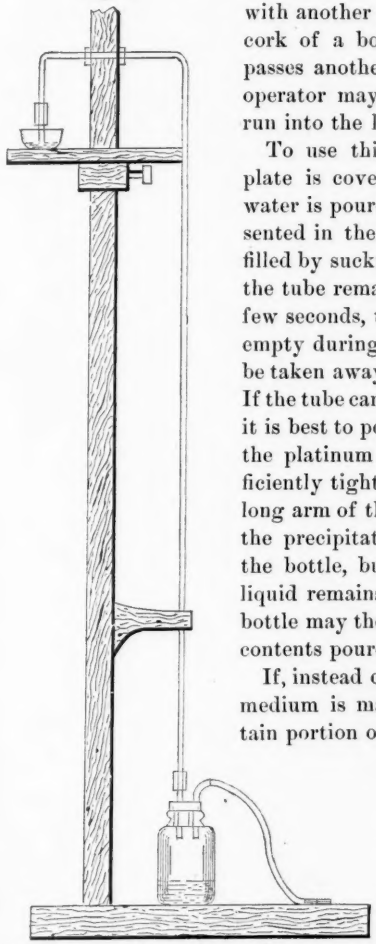
Very full details relating to asbestos filters may be found in an interesting paper of Mr. F. A. Gooch, read before the American Academy of Science, Feb. 13th, 1878, and published in the *Chemical News*, **37**, 181. The author does not seem to be aware that I had proposed the use of asbestos pulp, in 1875, as mentioned above, by pouring the pulp over a perforated plate.

In the arrangement introduced by Mr. Gooch, the filtered liquid is forced through asbestos, lying on the perforated bottom of a crucible, by the action of an aspirator. There is a tight joint formed around the crucible, by forcing it into a large rubber tube, which also fits tightly on the top of a glass funnel, in the manner proposed for porous earthenware cones by Prof. Munroe. There is no doubt that a very good aspirator, for this filtering apparatus, would be a straight glass tube having a small diameter, connected by a rubber tube with the stem of the glass funnel.

With the new form of filtering apparatus, having a perforated platinum plate, with tube attached, any form of aspirator may be used, and there is no difficulty in using a vertical tube having a small diameter, like those already mentioned, in which the suction is caused by the weight of a column of the filtered liquid held in suspension. This aspirator with filter, shown in section, is represented in Figure 3. The aspirator tube is bent twice at its upper end, and there

terminates in a short vertical tube about 3 centimeters long, connected with the platinum tube, attached to the perforated plate, by a rubber tube. The long vertical portion of this tube is connected, at its lower end, by a short rubber tube, with another glass tube passing through the cork of a bottle. Through the same cork passes another tube, by means of which the operator may start the liquid, and make it run into the long vertical tube.

Fig. 3.



To use this apparatus, if the perforated plate is covered with filter paper, distilled water is poured in the platinum dish, represented in the figure, and the vertical tube is filled by sucking air from the bottle. When the tube remains filled with liquid, for even a few seconds, there is no fear of its becoming empty during the filtration. The bottle may be taken away and a beaker glass substituted. If the tube cannot be made to retain the liquid, it is best to pour some of the precipitate in the platinum dish, and this will make a sufficiently tight joint to keep the liquid in the long arm of the tube. By doing this, some of the precipitate may at first be carried into the bottle, but very soon nothing, but clear liquid remains in the glass tube. The glass bottle may then be taken away, and its liquid contents poured back into the platinum dish.

If, instead of a sheet of paper, the filtering medium is made from asbestos pulp, a certain portion of the pulp will inevitably pass through the glass tube at first. This will have to be poured back into the platinum dish, even if no portion of precipitate has gone through. If paper pulp is used, and only a small portion passes through, without any of the precipitate, there is no necessity of pouring it back.

After the tube has once remained permanently filled with the filtered liquid, no further difficulty will be experienced. The rest of

the liquid to be filtered may be gradually poured in the platinum dish, and subsequently hot water is added to wash the precipitate.

After the operation is completed, if the platinum tube is slipped from the rubber tube which connects it with the aspirator, the water held in the platinum tube will fall back in the crucible. This is easily got rid of by subsequent evaporation, but this quantity of water, and that which remains below the platinum plate, may be mostly carried off through the aspirator by carefully removing the precipitate from a point on the edge of the paper disk, and lifting this up with the point of a needle just sufficiently to let air go in, to clear the aspirator tube from liquid.

XXXIII.—A Method for the Analysis of Mustard.

By Albert R. Leeds and Edgar Everhart.

During the past summer a large number of analyses of various articles of food and drink was made by the authors, on behalf of the State of New Jersey. Among the articles analyzed were thirty different kinds of mustards, as sold in shops. The method of analysis followed was that given in all text-books on the subject, and especially recommended by Blythe and Hassall. The process consists, as is well known, in estimating the moisture by drying at 100–110°; in determining the ash for the detection of mineral adulteration, and weighing the oil. The other adulterations are determined only qualitatively.

In this method reliance is placed principally on the estimation of the oil, and from this is calculated the amount of mustard supposed to be present in the mixture. Blythe gives the following formulæ for calculating the amount of mustard in a mixture of flour and mustard: x = amount of mustard and y amount of oil found,

$$\frac{33.9x}{100} + \frac{1.2\,(100 - x)}{100} = y \text{ and } \frac{36.7x}{100} + \frac{2\,(100 - x)}{100} = y.$$

This method of analysis and calculation might do very well if no foreign fat were added, or if none of the original mustard oil were extracted. In fact, however, flour baked in oil or fat is frequently added to a mustard from which a portion of the original oil has been extracted, and furthermore, mustard, before being put on the market, is subjected to hydraulic pressure and loses from 12 to 20 per cent. of its oil. From this method of analysis, it is evident that satisfactory or reliable results cannot be obtained.

So far as is known, there has been only one attempt made to analyze mustard by its separate constituents. Hassall, in his book on "Food, its Adulterations and the Method for their Detection," proposes an analysis, partly direct and partly indirect. His method, and the results obtained by it, are those most quoted both in English and foreign books and journals.

His plan of analysis is as follows: The moisture and ash are determined as ordinarily, and the oil by extracting with ether. The myronate of potash is estimated by taking advantage of its well-known reaction with the myrosine contained in the mustard flour, in presence of water. Forty or fifty grains of the mustard are allowed to digest for twenty-four hours, with about 250 c.c. of water in a well-corked flask. At the end of that time all the myronate of potash will have been decomposed by the ferment myrosine into glucose, sulphate of potash, and mustard oil (allylthiocarbamide), according to the equation $C_{10}H_{18}KNS_2O_{10}=C_6H_{12}O_6+KHSO_4+C_4H_5NS$. The contents of the flask are distilled, and all of the allylthiocarbamide goes over with the water vapor. The end of the condenser dips below the surface of some strong ammonia water to prevent loss of the volatile oil. When no more oily drops come over with the distillate, the receiver and its contents are removed and allowed to stand until the allylthiocarbamide has combined with the ammonia, forming thiosinnamine ($C_4H_5NS.NH_3$). The solution is evaporated to dryness in a tared platinum dish, and from the amount of thiosinnamine found, is calculated the myronate of potash.

So far the method is all that can be desired, but the remaining part is open to very serious objections. For the determination of the myrosine and sulphocyanide of sinapine, a combustion of the mustard is made with soda-lime for the total nitrogen, and another portion is fused with alkaline carbonates and nitrates, to estimate the total sulphur. As much nitrogen and sulphur as is contained in the myronate of potash, is subtracted from the total nitrogen and sulphur, and from the two residues are calculated the amounts of myrosine and sulphocyanide of sinapine. The cellulose is estimated by difference.

The whole of the sulphur residue, and so much of the nitrogen as is necessary, are calculated into sulphocyanide of sinapine, and the remaining nitrogen into myrosine. But as myrosine contains about 1.6 per cent. of sulphur, further calculations are necessary. Such calculations may or may not yield correct results, for one has as much right to calculate all the remaining sulphur first into myrosine, or all the nitrogen into either myrosine or sulphocyanide of sinapine, as the

sulphur into the last-named compound. The results cannot be calculated algebraically because there is only one equation, and this equation has two unknown factors. In one of the samples of mustard analyzed by Hassall he finds myrosine 31.686 per cent., sulphocyanide of sinapine 5.714 per cent. Taking his percentages of nitrogen and sulphur, and calculating the total nitrogen first into myrosine, one finds, myrosine 31.43 per cent., sulphocyanide of sinapine 3.95 per cent.

For the reasons above detailed, the following attempt was made to work out a method for the analysis of mustard, which should be direct throughout, and should rest on an actual separation and estimation of the several constituents. The moisture and ash are determined as usual. The mustard oil is extracted with ether in the following manner: A weighed portion of mustard, after drying at 105°, is carefully brushed into a plaited filter. The filter and its contents are placed in a funnel with straight sides. The stem of the funnel is connected, by means of a well-fitting cork, with a small tared flask partially filled with ether, while the funnel itself is connected with an upright condenser. On cautiously boiling the ether, its vapor is constantly condensed, and, falling on the mustard, extracts the oil which is retained in the flask. When all of the oil is removed, the ether is distilled off, and the flask and contents, after drying at 100°, re-weighed. The difference between the weight of the flask alone, and that of the flask and oil, gives the amount of oil. After the ether has evaporated from the mustard residue, a tared flask, containing half water and half alcohol, is substituted for that containing ether, and the contents are boiled and condensed as before. The dilute alcohol dissolves both the sulphocyanide of sinapine and the myronate of potash, while it coagulates the myrosine and leaves both it and the cellulose undissolved. After all the sulphocyanide of sinapine and myronate of potash have been extracted, the contents of the flask are rinsed into a tared platinum dish, evaporated to dryness, dried at 105°, and weighed. The dish and contents are then ignited and weighed. The difference of weight before and after ignition, gives the total amount of sulphocyanide of sinapine and myronate of potash. Subtracting the amount of the latter, the difference is the amount of sulphocyanide of sinapine.

After the extraction with alcohol, the filter contains only the myrosine and cellulose, together with a little coloring matter. The alcohol is allowed to evaporate spontaneously, and then the myrosine and cellulose are treated in the cold with a one-half per cent. soda

solution. The solution containing the myrosine is decanted through a weighed filter, and the residue is treated again in the same manner. By this treatment all the myrosine is obtained in solution. The cellulose on the filter is dried, weighed, ignited, and the ash weighed. The difference between the two weights gives the cellulose.

The solution containing the myrosine is just neutralized with dilute hydrochloric acid, and about 50 c.c. of Ritthausen's cupric sulphate solution added. The solution is then *exactly* neutralized with dilute soda, and the heavy green precipitate of the compound of copper and myrosine allowed to settle to the bottom of the beaker.

The precipitate is collected on a weighed filter and dried at 110°. After drying, the weight of the precipitate is taken. It is then ignited, and the ash weighed, the difference giving the total amount of myrosine.

The two following analyses of a sample of Brown Mustard Farina, prepared by H. K. & F. B. Thurber & Co., New York, were made simultaneously. Afterwards a third analysis was made on the same sample.

ANALYSIS OF BROWN MUSTARD FARINA.

	1	2	3
Moisture	6.78	6.90	6.82
Myronate of potash	0.61	0.61	0.72
Sulphocyanide of sinapine	10.97	11.19	11.21
Myrosine	28.45	28.70	28.30
Mustard oil	29.22	29.21	29.19
Cellulose by difference	20.24	19.55	20.06
Ash	3.73	3.84	3.70
	100.00	100.00	100.00

A combustion was made of the same mustard, and the nitrogen determined. The sulphur was likewise determined by fusing with alkaline carbonates and nitrates, and precipitating with barium chloride.

Nitrogen = 5.337 per cent. Sulphur = 1.489 per cent. Calculating the amounts of nitrogen and sulphur in the myronate of potash, the sulphocyanide of sinapine and the myrosine, we find nitrogen, 5.342 per cent., and sulphur, 1.50 per cent.

If the amounts of the three last named constituents of the mustard be deduced from the total amounts of nitrogen and sulphur according to Hassall, the following will be the percentages :

Myronate of potash	0.61 per cent.
Sulphocyanide of sinapine	10.71 "
Myrosine	28.52 "

In this case, the results obtained by calculation from the percentages of nitrogen and sulphur, are almost identical with those obtained by direct determinations. But the greater ease and certainty of the direct method, and the very considerable errors which are possible when calculations are instituted upon results differing but very slightly from the true ones, must strongly recommend, it appears to us, the direct as compared with the indirect method.

If the mustard is adulterated with starch or flour, the foregoing scheme of analysis may be used as well in the case of pure mustard. After the extraction of the oil with ether, and the sulphocyanide of sinapine and myronate of potash with alcohol, the residue may be treated either with malt extract or with acids under pressure to convert the starch into glucose. The glucose may be estimated as usual.

Fearing that starch was not entirely insoluble in dilute alcohol, and not being able to learn anything on the subject from books, an experiment was made of boiling starch for some time in a mixture of half alcohol and half water. The boiling liquid was filtered hot, and to the filtrate a few drops of iodine solution added. No blue coloration taking place, the starch may be considered insoluble in dilute alcohol, and hence could not interfere in the determination of the sulphocyanide of sinapine and myronate of potash.

XXXIV.—Upon the Compounds of the Aromatic Bases with Metallic Salts, with a Note upon Thiocarbanilide.

By Albert R. Leeds.

Introduction.

The author was led to a study of these compounds by the following considerations :—

I. The energy, in many cases attended by the evolution of much heat, with which a number of them are formed.

II. The hope that a study of the structural formulæ of compounds of so considerable a degree of complexity, and containing both metallic and non-metallic basic radicals in combination with acid radicals, might be attended with theoretic interest.

III. The expectation, which, indeed, first suggested the inquiry, that by removal or replacement of the metallic element in these compounds by reactions, induced by organic compounds of sulphur and related substances, these metallo-aromatic bodies would serve as material in the institution of an interesting line of research. This

expectation was in part verified, such derivatives being obtained either by laboratory operations, conducted as usual, or with the aid of sun-light, but it was then found that they had already been prepared by simpler and more direct methods. These remarks apply more especially to thiocarbanilide and related compounds.

But it was found that the great majority of these compounds were quite unstable, undergoing decomposition merely by treatment with water. Consequently, the attempts to form them by double decomposition of aqueous solutions of their constituent salts were mainly unsuccessful. Moreover, the double salt of the aromatic base, containing the same acid radical in combination with both base and metal, could not be formed. This result is in opposition to that obtained by Schiff, not only in the case of antimonious chloride, but also in regard to other compounds. Finally, if the combinations are to be regarded as either amines or ammoniums, in which a portion of the hydrogen is replaced by a metal, and the radical thus formed enters into combination with either the acid itself or the acid radical, then it might be anticipated that such a compound would again unite with platinic chloride to form a double salt. Numerous attempts were made to form such double salts, but they were unsuccessful, the metallic salt dropping out, and a double chloride of platinum and the aromatic base alone remaining.

In formulating them, therefore, as ammoniums, which is the simplest mode of explaining their composition, these points of weakness in the experimental data must be kept in mind. And whilst the following compounds might receive a nomenclature in accordance with the theory of their being metallo-ammoniums, the antimony compound being the chloride of triphenylstibonium, the salt of mercury being the chloride of diphenylmercurammonium, and so on, yet I have seldom used these terms, not only because of their cumbrous character, but also because they necessarily assume what as yet is not very satisfactorily proven.

Authorities consulted.

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" " Researches upon the Trimetalaniles, C. R., **56**, 1095.

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O. Klein: Upon the Combinations of Organic Bases with Mercuric Chloride. *Ber. der Deutsch. Chem. Gesell.*, **11**, 743 and 1741.

LIPPMANN and VORTMANN: Upon a Combination of Cobaltous Chloride with Aniline. *Ber. der Deutsch. Chem. Gesell.*, **11**, 1069.

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Compounds with Aniline.

I. ALUMINA SALTS.

Aluminic chloride.—Three molecules of aniline were heated with one of aluminum chloride. The resulting compound was washed with alcohol, water and ammonium chloride, in none of which it appeared to dissolve. After washing out all the excess of aniline with alcohol, a white crystalline powder remained.

The operation was repeated, alcohol only being used to dissolve the resultant compound. The crystals which separated out of the first portions of the alcohol, proved to be chloride of aniline. The white powder which remained after repeated treatment with boiling alcohol, was alumina. In other words, no compound of aniline with aluminic chloride is formed when the former is heated with Al_2Cl_6, $6H_2O$. The latter is decomposed into alumina and hydrochloric acid, and merely a hydrochlorate of aniline is formed.

Aluminic sulphate.—On mixing the two bodies, only a slight elevation of temperature ensued, and the heat was afterwards raised to the boiling point of aniline. The excess of aniline was washed out by repeated decantation with boiling alcohol, in which it is not very soluble, and a portion of the compound crystallized from the same solvent. It crystallized, apparently, in small white needles. On heating, these crystals blackened, and burnt with a small flame. Their analysis gave only 4.4 per cent. of alumina. The compound $3C_6H_7N.Al_2(SO_4)_3$, requires 8.84 per cent. of alumina. They were not a compound with aniline, but some of the undecomposed sulphate together with aniline which had not been perfectly removed by repeated washing.

Aluminic hydrate.—Neither this nor any other salt of alumina entered into combination.

II. ANTIMONY.

Antimonious chloride, $3C_6H_9N.SbCl_3$.—First formed by adding 3 molecules of aniline to one of antimonious chloride and heating. The resulting compound had a pinkish color, probably due to exposure to the air. It lost this color after washing with alcohol, and became perfectly white. It was decomposed by water.

Schiff prepared this substance as above, and also by adding aniline to a solution of antimonious chloride in benzine. This yielded a white crystalline mass, which was soluble in aniline only, and crystallized out of the latter in slender needles. According to Schiff, it is converted into a double salt by hydrochloric acid, melts at 80°, solidifies again in long needles, and is partially decomposed by distillation (Watt's Dictionary, **4**, 474).

These statements were not verified. On the addition of hydrochloric acid the compound was decomposed, hydrochlorate of aniline crystallizing out of the solution. It does not melt at 80°, nor even at 240°, being in part decomposed and partially subliming. This was true both when heated in the air, and when the attempt was made to distil it in vacuo.

When the same compound was made by mixing antimonious chloride with aniline, the temperature rose from 23°.5 to 82°.5. It was washed repeatedly with alcohol, in which it is but slightly soluble, and a portion recrystallized from the same. It formed minute needle-shaped crystals. It was decomposed by water, the solution giving the reaction for antimony and aniline.

Antimonic chloride, $5C_6H_7N.SbCl_5$.—Formed in like manner as the preceding compound, which it closely resembles in appearance and properties. The temperature rose from 22°.5 to 85°.

Antimonious iodide, $3C_6H_7N.SbI_3$.—"To obtain the combination of antimonious iodide with aniline, it is necessary to raise the temperature to 100° or 120°. If an excess of aniline is used, the compound is formed in little yellow needles, colored undoubtedly by a small quantity of iodine. By distillation a large portion is decomposed" (Schiff).

I did not repeat the experiment.

Antimonious sulphide.—Does not enter into combination.

III. ARSENIC.

Arsenious chloride, $3C_6H_7N.AsCl_3$.—On the addition of 3 molecules of aniline to one of arsenious chloride, an energetic combination ensued, the temperature being considerably raised, and the mixture solidifying afterwards to a whitish crystalline mass. This was purified by recrystallizing three times from alcohol. The final product was in small white crystals, not well defined and becoming red by exposure to the air.

According to Schiff (*loc. cit.*), this compound melts at about 90°, distils without decomposition between 205° and 210°, and is some-

what soluble in water, with separation of arsenious acid. We sublimed it in vacuo, at circa 205°, at which temperature it sublimes without previous melting and with partial decomposition. The product lost the red tint of the original substance, and was in the form of minute white plates, polarizing finely. It was decomposed by hydrochloric acid, and after slow evaporation of the hydrochloric acid solution, only aniline hydrochlorate remained, the $AsCl_3$ having volatilized.

Arsenious iodide, $3C_6H_7N.AsI_3$.—"It forms at an elevated temperature, and is decomposed neither by cold water nor by dilute hydrochloric acid. It is slightly soluble in benzine and in cold alcohol. Boiling alcohol decomposes it in a curious manner; brown flocks of monoiodide of arsenic are obtained, and the alcohol on evaporation leaves long needles of hydriodide of iodoaniline" (Schiff).

$$3C_6H_7N.AsI_3 = AsI + C_6H_6IN.HI + 2C_6H_7N.$$

The experiments were not repeated.

Arsenious sulphide.—Does not enter into combination.

IV. BARIUM.

No combination ensued when aniline was subjected to the action of barium acetate, chloride, iodide, nitrate and sulphide.

On heating aniline with barium chloride or iodide, dissolving in boiling ammonium chloride, and crystallizing, small white needles were formed. On the addition of water, these went into solution very readily. After washing with alcohol, they were found to consist only of unchanged barium chloride or iodide. When the mass obtained by heating aniline with the barium salt was treated with alcohol, no compound could be crystallized out.

V. BISMUTH.

$3C_6H_7N.BiCl_3$.—According to Schiff (*loc. cit.*), this is a fusible, indistinctly crystalline mass, which is very slowly decomposed by water, and turns violet when heated. The experiment was not repeated. I found that the nitrate formed no compound.

VI. CADMIUM.

Cadmium chloride, $2C_6H_7N.CdCl_2$.—This and the corresponding compounds of cadmium bromide and iodide, were obtained by heating with excess of aniline. On boiling all went into solution, but after cooling the entire mass crystallized in a solid lump. The excess of aniline was washed out with alcohol, in which these cad-

mium compounds are insoluble. Neither could they be crystallized from chloroform, ether, or water. Ammonia exercised a solvent action, but appeared at the same time to effect some decomposition. The three compounds were boiled with calcium chloride, in which they were readily soluble, and from which they crystallized out in fine white needles. The $2C_6H_7N.CdCl_2$ was purified from $CaCl_2$ by redissolving in water, from which it crystallized in very minute, flexible needles, of a white color, with silky luster. These needles readily compacted themselves into soft, tufted masses.

As crystallized from ammonium chloride, all the compounds formed by aniline with cadmium or other salts were not pure. It was found to be the best method, in almost all instances, to heat the salt directly with the aniline, and, after getting rid of the excess of the latter, to crystallize repeatedly out of alcohol. When the cadmium chloride was so made, the temperature rose from 18° to 42°.

Cadmium bromide, $2C_6H_7N.CdBr_2$, as crystallized from calcium chloride, formed longer needles, which aggregated in little tufts and had a satin luster.

Cadmium iodide, $2C_6H_7N.CdI_2$.—This compound, when recrystallized from boiling ammonium chloride, formed like the two former when crystallized from the same solvent, long thick white needles. The needles were flat, and of a beautiful pearly luster. On exposure to light and air their color turned to a faint pink.

Cadmium nitrate, $2C_6H_7N.Cd(NO_3)_2$.—It was obtained by boiling cadmium nitrate with excess of aniline, and washing out the latter with alcohol. It crystallizes in white needles, aggregating into lamellar masses, with a silky luster.

VII. CALCIUM.

Calcium chloride, $2C_6H_7N.CaCl_2$.—On mixing aniline with calcium chloride, the temperature rose from 18° to 20°. The mixture was then raised to the boiling point of the aniline, when, on cooling, a hard crystalline mass was formed. This was drained from the excess of aniline, pulverized, and dried between filter paper. On account of the extreme solubility of the compound in alcohol, it was washed only once in this solvent, and then dissolved and crystallized. It formed long, stout prisms, perfectly colorless, and of a glacial appearance.

$2C_6H_7N.CaI_2$.—The temperature of the mixture rose from 20°.5 to 24°. It behaved exactly like the corresponding chloride, forming crystals similar to those above described.

Experiments made with a view of crystallizing out the compounds from boiling ammonium chloride, were not satisfactory, owing to their great solubility both in water and alcohol.

VIII. CHROMIUM.

Neither chromic chloride or sulphate entered into combination.

IX. COPPER.

When cupric acetate is added to aniline, the mixture immediately becomes black, and solidifies to a very hard mass. In order to insure complete union this mass was broken up and triturated in a mortar with aniline. After washing several times with alcohol and boiling it with the same, there was left a black, uncrystallizable mass. When dissolved in hydrochloric acid this substance gave no reaction for aniline.

Cuprous chloride and cupric nitrate.—Similar black substances were produced, and no certain evidence was obtained that definite compounds with these salts were formed, or if formed, were stable in contact with air or solvents. The same results were true of cupric sulphate.

X. COBALT.

Cobaltous chloride, $2C_6H_7N.CoCl_2$.—When the cobaltous chloride and aniline were mixed together, the temperature of the mixture rose from 18°.5 to 104°.5. The resulting compound was washed several times with alcohol. Finally one portion was recrystallized from absolute, the other from common alcohol. Both formed very beautiful red crystals, the former in rhomboidal plates, the latter in prismatic needles. When exposed to the air, these crystals assume a cobalt blue color.

The constitution of these bodies has already been investigated by Lippmann and Vortmann, who formed the first substance as a pale red precipitate by the addition of an alcoholic solution of cobaltous chloride to aniline. They found its composition to be $2C_6H_7N.CoCl_2 + 2C_2H_6O$. The blue compound is derived from the former, by spontaneous decomposition in the atmosphere, forming $2C_6H_7N.CoCl_2$.

We found, as had already been shown by the authors abovementioned, that these compounds are decomposed into their constituents on solution in water. Also that on treatment with an alcoholic solution of platinic chloride, a double salt with aniline, not containing in combination the cobaltous chloride, is formed.

Cobaltous nitrate and sulphate.—In aqueous or alcoholic solutions, or when heated directly with aniline, these salts did not combine.

XI. IRON.

Ferric chloride.—On adding ferric chloride to aniline, so energetic a reaction ensued that the temperature of the mixture rose to 80°. A black mass was formed, incompletely soluble in alcohol and water, and which could neither be sublimed nor crystallized from any solvent which was employed.

Ferrous chloride, $2C_6H_7N.FeCl_2$.—On adding aniline to ferrous chloride the temperature is raised from 21° to 23°. It solidifies to a hard yellowish mass. After removing the excess of aniline by washing with alcohol, and dissolving in alcohol, the compound crystallizes in yellowish needles.

Ferrous sulphate.—It does not enter into combination.

XII. LEAD.

None of the salts of lead form compounds with aniline.

XIII. MAGNESIA.

The same is true of the magnesia salts.

XIV. MANGANESE.

Manganous chloride, $2C_6H_7N.MnCl_2$.—An alcoholic solution of two molecules of aniline was added to one molecule of manganous chloride likewise dissolved in alcohol. A cloudiness formed immediately, and the compound slowly crystallized out as beautiful white rhombic plates, with a pearly luster.

When the compound with manganous chloride was formed by direct addition of aniline, the temperature rose from 18° to 24°.

Manganous bromide, $2C_6H_7N.MnBr_2$.—By direct mixing of the constituents, a rise of temperature from 21° to 40° resulted. It separated from alcohol in small colorless crystals.

Manganous iodide, $2C_6H_7N.MnI_2$.—The temperature rose from 21° to 39°. The small, colorless crystals obtained from the alcoholic solution were similar to the bromine compound.

Manganous sulphate.—It did not enter into combination.

XV. MERCURY.

Mercuric chloride, $2C_6H_7N.HgCl_2$.—"It is precipitated on adding mercuric chloride to an excess of alcoholic aniline. It is a nacreous precipitate, which must be collected on a filter and washed with a small quantity of alcohol. It gives off a small quantity of aniline

even at 60°, and turns yellowish (Gerhardt, Traité, **3**, 86). According to Schiff, it decomposes at 100°, yielding aniline-red, and a similar red product is obtained by heating aniline with mercurous chloride to 150°. (Probably the aniline used contained toluidine.)" Watts' Dict., **4**, 475.

I obtained the salt by heating the aniline directly with mercuric chloride and crystallizing out of ammonium chloride. The crystals were several millimeters in length, and of a yellowish-white color. They were not pure, and the compound is best obtained by heating aniline directly with mercuric chloride. It crystallized from alcohol in small white needles. The combination with mercuric chloride caused an elevation of temperature from 24° to 106°.

$NC_6H_5.Hg.HCl$.—According to Foster (*Ber. der Deutsch. Chem. Gesell.*, **7**, 294), this compound is produced together with $2C_6H_7N.HgCl_2$ when the boiling solutions of aniline and mercuric chloride are mixed together. The $2C_6H_7N.HgCl_2$ remains in solution, whilst the new compound, a "phenylated white precipitate," settles as a yellow precipitate, and by repeated exhaustion with boiling alcohol may be obtained pure. The above formulæ was in accordance with the analysis :—

	Theory.	*Found.*
C	21.98	21.60
H	1.83	2.00
N	4.28	4.52
Cl	10.84	11.15
Hg	61.07	60.96-61.47.

Mercurous chloride.—It could not be made to enter into combination.

Mercuric iodide, $2C_6H_7N.HgI_2$.—After dissolving mercuric iodide in boiling aniline, the solid mass which formed on cooling was dissolved in boiling ammonium chloride, filtered and crystallized. Prismatic needles were formed of considerable size, which decomposed on attempting to further purify them by recrystallization from water.

According to Schiff, this compound forms little yellowish leaves, which can be obtained from the nitrate by double decomposition.

This statement of Schiff could not be verified. Neither could a compound be crystallized out from a solution of the mass, formed by heating aniline with mercuric iodide, in alcohol. No evidence of the existence of a compound of these two bodies could be obtained.

Klein states that he formed the compound $2C_6H_7N.HgI_2$ with a melting point of 60°.

Mercuric bromide, $2C_6H_7N.HgBr_2$.—No attempt to make it. Formed, according to Klein, in long crystals when crystallized out of alcohol. M. pt., 110°–112°. Decomposed by boiling water.

Mercuric nitrate, $2C_6H_7N.Hg(NO_3)_2$.—According to Schiff, this is obtained as a white precipitate, when aniline is added to a solution of mercuric nitrate. The powder becomes crystalline if it is digested, while still moist, with cold dilute nitric acid. Small brilliant leaves are obtained, if a solution of the slightly acidulated nitrate is used, or if the neutral mercuric solution is added drop by drop to an acidulated solution of nitrate of aniline. In every case the same compound is formed and not the double salt. The salt is unalterable in the air, and slightly soluble in dilute nitric acid.

"When heated with water, the salt yields aniline nitrate and changes to a dense white crystalline powder, $C_6H_5.NH.HgNO_3$."

"This last salt, diffused during several days with a large quantity of boiling water, gives up more aniline nitrate, and forms $(C_6H_5N)_2$-$Hg_3(NO_3)_2 + 2H_2O$. When heated with water for eight more days, this last compound suffers no further alteration."

Mercurous nitrate.—"Mercurous nitrate likewise combines with aniline to form $2C_6H_7N.Hg_2(NO_3)_2$, a white crystalline powder, very readily decomposed by a slight elevation of temperature, with reduction of the mercury."

The above statements of Schiff, with regard to the compounds of mercuric and mercurous nitrate, could not be verified, and no proof was obtained of the existence of any of the bodies above spoken of.

When mixed with aniline, the mercurous nitrate caused an elevation of temperature from 21°.5 to 79°.5, and the mass increased greatly in volume, forming a black crystalline substance. After removing the excess of aniline it was dissolved in alcohol, from which it did not crystallize satisfactorily.

This fact, together with the circumstance that the crystals in aqueous solution gave no reaction for aniline, shows that no compound was formed.

Mercuric cyanide, $2C_6H_7N.HgCy_2$.—On adding powdered mercuric cyanide to aniline, the rise of temperature was only from 17° to 21°, and in order to insure complete combination, the mixture was heated to the boiling point of the aniline. The latter being in excess, it dissolved the resulting compound at the same time that it

entered into combination with the cyanide, and on cooling and standing the $2C_6H_7N.HgCy_2$ was deposited as stout prisms, six-sided, and of a vitreous luster. These crystals were freed from adhering aniline by washing with alcohol.

According to Schiff, $2C_6H_7N.HgCy_2$ separates in long, magnificent needles on mixing aniline with a hot aqueous solution of mercuric cyanide. It melts very readily, and is resolved into aniline and cyanide of mercury at 80°. It is attacked neither by alkalies nor by biniodide of potassium.

XVI. NICKEL.

Nickel chloride, $2C_6H_7N.NiCl_2$.—It united directly with aniline, the temperature rising from 20° to 40°. The product solidified to a dark green mass, which crystallized out of alcohol in clusters of green needles. It altered in color on keeping.

According to Lippmann and Vortmann, who prepared this compound somewhat differently, the body obtained from alcohol contains $2C_6H_7N.NiCl_2.2C_6H_6O$, and gives off alcohol at 100°, becoming yellowish-green, and forming $2C_6H_7N.NiCl_2$.

Nickel sulphate.—Does not enter into combination.

XVII. PALLADIUM.

Palladium chloride formed a compound, but the amount of the salt at my disposal was too small to admit of study.

XVIII. PLATINIC CHLORIDE AND PLATINOUS CHLORIDE.

The former does not combine. The compounds of the latter will be found described in Beilstein's Handb. der Organ. Chemie, p. 875.

XIX. POTASSIUM.

No combination ensued between aniline and potassium iodide, or with the other salts of potassium experimented upon.

XX. STRONTIUM.

Its salts do not combine with aniline.

XXI. TIN.

Stannous chloride, $2C_6H_7N.SnCl_2$.—"It is obtained by mixing the same number of equivalents of stannous chloride and aniline. A slight evolution of heat occurs, and at the end of some hours a crystalline mass is obtained which is slightly soluble in cold water and in alcohol, but which is decomposed by these liquids on warming" (Schiff).

On mixing aniline with stannous chloride the temperature rose from 22° to 35°. The compound crystallized out of alcohol in small white needles (Leeds).

Stannic chloride, $4C_6H_7N.SnCl_4$.—"It has been obtained by the union of 2 equivalents of aniline to 1 eq. of stannic chloride. An intense heat is produced at the moment of mixture, and it is necessary, to avoid explosions, to place the vase in a cooling mixture. Under these conditions, a perfectly white crystalline mass is obtained" (Schiff).

"Or if one adds the aniline drop by drop to a solution of stannic chloride in benzine, a white crystalline powder is seen to deposit at once, which is the $4C_6H_7N.SnCl_4$, insoluble in benzine. It is decomposed by water, stannic hydrate being precipitated" (Schiff).

When stannic chloride was added, the temperature rose from 21° to 60°. Its crystallization from alcohol yielded small white needles, turning bluish-gray after a long interval (Leeds).

Stannous iodide, $2C_6H_7N.SnI_2$.—The temperature rose from 21° to 40°, and the compound crystallized out of alcohol in grayish-white needles.

XXII. TITANIUM.

Titanium chloride, $4C_6H_7N.TiCl_4$.—The flask which contained the titanium chloride was broken, and the vapor allowed to flow down in contact with the aniline. It was energetically absorbed, forming a hard mass of a reddish color. This was dissolved in alcohol, the compound separating out in white, feathery crystals.

XXIII. URANIUM.

Uranium acetate.—Formed no compound.

Uranyl chloride, $2C_6H_7N.UO_2Cl_2$.—The chloride in alcohol solution was added to the alcoholic solution of aniline, and allowed to stand. The compound was slowly precipitated out as small yellow needles. Owing to their solubility in alcohol they were washed with ether, and afterwards recrystallized from alcohol. No elevation of temperature was noted on mixing the alcoholic solutions.

Uranium nitrate entered into combination under the same circumstances as the chloride, but the precipitate formed immediately on mixing the alcoholic solutions, as a heavy yellow crystalline compound.

XXIV. ZINC.

Zinc chloride, $2C_6H_7N.ZnCl_2$.—"Crystallizes in oblique, rhomboidal prisms, anhydrous, soluble in water and in alcohol, especially in

the cold. By prolonged boiling of these solutions the salt is decomposed into aniline and zinc chloride. It combines with platinic chloride, forming granular crystals" (Schiff).

Zinc iodide, $2C_6H_7N.ZnI_2$.—On adding the zinc salt to an excess of aniline, the temperature rose from 17°.5 to 63°, and the substances united to form a white mass, which became very hard and compact. The excess of aniline was removed by washing with a small amount of alcohol. The residue was dissolved by digesting with alcohol under a return cooler, and after two recrystallizations became quite pure. It formed unusually brilliant prismatic needles of about a centimeter in length, with a pearly luster, and aggregating into radiate clusters.

Zinc bromide, $2C_6H_7N.ZnBr_2$.—It was prepared in like manner, the temperature of the mixture rising from 16° to 62°. The crystals were similar to those of the foregoing compound, but not so long or brilliant.

Zinc sulphate.—"It is more soluble than the preceding salts, and can be used with advantage to prepare them by the method of double decomposition" (Schiff).

I did not succeed in forming a compound with zinc sulphate.

Compounds with Paratoluidine.

I. CADMIUM.

Cadmium nitrate, $2p\text{-}C_7H_9N.Cd(NO_3)_2$.—The first method employed in making this compound was by the addition of an aqueous solution of paratoluidine nitrate to an aqueous solution of cadmium nitrate, both salts being in molecular proportions. But the toluidine nitrate crystallized out separately.

The second method was by heating the cadmium nitrate directly with paratoluidine. A solid white mass was formed, which yielded, when recrystallized from benzine or alcohol, white needles compacted together like leaves.

Cadmium bromide, $2p\text{-}C_7H_9N.CdBr_2$.—It was prepared by mixing together the alcoholic solutions of the two bodies in molecular proportions, and precipitated as a dense white crystalline mass.

Cadmium iodide, $2p\text{-}C_7H_9N.CdI_2$.—From the alcoholic solutions it was precipitated in white prismatic needles, which were washed with alcohol. It was also formed by heating the cadmium iodide directly with fused paratoluidine, and recrystallization from alcohol. The temperature of the fused mass rose from 67° to 90°.

II. COPPER.

On the addition of paratoluidine nitrate in aqueous solution to an aqueous solution of cupric nitrate, a dark green precipitate was obtained, which speedily blackened. On standing, crystals of impure toluidine nitrate formed on the sides of the vessel, and a blackish mass containing copper and some organic matter was left behind. But no definite compound could be isolated.

A similar change took place in the compound formed on the addition of cupric chloride to paratoluidine hydrochlorate, an uncrystalline blackish mass remaining.

III. COBALT.

On mixing the aqueous solutions of the nitrates, no compound was formed, the constituents crystallizing out separately, with the formation of a small amount of a blackish mass, due to partial decomposition.

The chlorides, likewise, did not enter into combination when their aqueous solutions were mixed together.

Lippmann and Vortmann have already explained the reaction* when an alcoholic solution of cobaltous chloride is added to paratoluidine.

IV. CHROMIUM.

Chromium sulphate.—After mixing the aqueous solutions of the two salts, they were allowed to evaporate spontaneously, when the constituents crystallized out separately.

Chromic chlorides.—A solution of chromic acid was reduced by alcohol and hydrochloric acid to Cr_2Cl_6, and added to an alcoholic solution of paratoluidine. The solutions solidified to a brown mass, from which, on treatment with water, the toluidine chloride crystallized out, leaving the chromium sesquichloride behind as a green powder.

V. GOLD.

One mol. of auric chloride dissolved in alcohol, was added to three molecules of toluidine dissolved in the same solvent. The liquid became dark purple and after a time deposited a sediment due to the reduction of the gold salt.

VI. MERCURY.

Mercurous nitrate, $2p\text{-}C_7H_9N.Hg_2(NO_3)_2$.—It was formed on adding an aqueous solution of toluidine nitrate to an aqueous solution

* *Ber. der Deutsch. Chem. Gesell.*, **12**, 81.

of mercurous nitrate, acidified with nitric acid. The salt separated out slowly in small opaque white needles. It was purified by washing with cold water; in hot water, acidified with nitric acid, it dissolved readily.

Mercuric nitrate.—The corresponding mercuric salt could not be obtained in a crystalline condition. The precipitate obtained on evaporating the aqueous solutions of toluidine nitrate and mercuric nitrate to a small bulk, was easily soluble in water, but would not crystallize from the solution.

Mercuric chloride, $2p\text{-}C_7H_9N.HgCl_2$.—It was obtained by adding 2 mols. of toluidine dissolved in alcohol to 1 mol. of mercuric chloride, likewise in alcoholic solution, and dissolving the precipitate in boiling ammonium chloride. It crystallized out in white needles an inch in length, which decomposed on treatment with water. For this reason the toluidine and mercuric chloride were heated together until combination ensued, the resulting compound dissolved in alcohol, and recrystallized from the same solvent. The crystals in this case were white also, but not of such great length as those obtained from the ammonium chloride solution.

According to Klein, it crystallizes out of ether in magnificent thick needles, and decomposes at 70°, giving off paratoluidine.

Mercuric cyanide, $2p\text{-}C_7H_9N.HgCy_2$.—Formed like the corresponding aniline compound, and crystallizing similarly. The crystals are much larger and have an adamantine luster.

VII. MANGANESE.

$2p\text{-}C_7H_9N.MnCl_2$.—This was prepared both by adding the alcoholic solutions of the two components, and by adding the manganese chloride to fused paratoluidine. It could not be obtained in pure white crystals, but only as a faint red crystalline powder.

VIII. SILVER.

One mol. of argentic nitrate dissolved in water was added to an aqueous solution of toluidine nitrate. No combination occurred, the toluidine nitrate crystallizing out in long white needles.

IX. URANIUM.

$2p\text{-}C_7H_9N.UO_2Cl_2$.—The attempt to prepare the salt by mixing the aqueous solution of uranyl chloride with an aqueous solution of toluidine hydrochlorate was unsuccessful: the yellow solution deposited a pink powder, while the toluidine hydrochlorate crystallized out.

No better result was obtained with the alcoholic solutions of uranyl chloride and of toluidine. The uranium salt separated out on standing as a yellow powder, and the toluidine alone crystallized from the alcohol.

In a third trial the alcoholic solutions of the two bodies in molecular proportions were mixed together, the alcohol evaporated off, and the residue dissolved in aniline. After long standing the compound crystallized out in long, thick, greenish-yellow prisms, apparently orthorhombic and doubly terminated. They were drained from the excess of aniline by pressing with filter paper, and washed with a little alcohol.

X. ZINC.

Zinc bromide, 2p-$C_7H_9N.ZnBr_2$.—Formed by adding to two molecules of fused paratoluidine, one molecule of zinc bromide. The temperature rose during the formation of the compound from 57° to 89°. By crystallization from alcohol a large yield of delicate white needles was obtained.

Zinc iodide, 2p-$C_7H_9N.ZnI_2$.—This was formed in the same manner as the preceding, the temperature of the fused mass rising from 61° to 91°. It crystallized from alcohol in long, extremely slender white needles, having a satin luster, and forming fan-like clusters.

For other compounds, see Beilstein's Lehrbuch, p. 936.

Compounds with Orthotoluidine.

I. CADMIUM.

2o-$C_7H_9N.CdI_2$.—Formed by adding the cadmium iodide directly to the orthotoluidine. The temperature rose from 18° to 45°. It crystallized from alcohol in fan-like aggregates of soft, small needles.

II. MERCURY.

Mercuric chloride, 2o-$C_7H_9N.HgCl_2$.—The temperature at moment of formation rose from 20° to 49°.5. It crystallized from alcohol in leaf-like crystals, having very much the appearance and luster of small tufts of mica.

Mercuric cyanide, 2o-$C_7H_9N.HgCy_2$.—Formed similarly. Separated in beautiful crystals, with superb adamantine luster. The temperature at the moment of formation rose from 18° to 21°.

III. MANGANESE.

2o-$C_7H_9N.MnCl_2$.—Formation-temperature rose from 18° to 22°. The compound was with difficulty obtained in a pure condition from the alcoholic solution, the crystals resembling the corresponding paratoluidine compound.

IV. ZINC.

Zinc bromide, 2o-$C_7H_9N.ZnBr_2$.—The temperature of the mixed components rose from 18° to 59°, with increase of volume. Formed compact white crystalline masses.

Zinc iodide, 2o-$C_7H_9N.ZnI_2$.—The temperature rose from 17° to 58°. Tufts of fine white needles.

Compounds with Metaxylidine.

I. CADMIUM.

Cadmium bromide, $2C_8H_{11}N.CdBr_2$.—Formed in the same manner as the corresponding aniline and toluidine compounds. The temperature rose from 17° to 42°. A pinkish crystalline powder. The color was probably due to alteration in contact with the air. As first crystallized from alcohol, it was in small white needles.

Cadmium iodide, $2C_8H_{11}N.CdCl_2$.—Formation-temperature rose from 18° to 42°. Separated from alcohol in minute white crystals.

II. MERCURY.

Mercuric chloride, $2C_8H_{11}N.HgCl_3$.—The temperature rose from 18° to 71°. It crystallizes from alcohol in white needles.

Mercuric cyanide, $2C_8H_{11}N.HgCy_2$.—Minute crystals, with superb adamantine luster, and with faces apparently of a rhombohedral character.

III. ZINC.

Zinc bromide, $2C_8H_{11}N.ZnBr_2$.—The temperature rose from 17°.5 to 61°.5, with a great increase of volume. Crystallizes from alcohol in very small needles, which compact themselves together in white botryoidal masses.

Zinc iodide, $2C_8H_{11}N.ZnI_2$.—The temperature rose from 16° to 59°. Crystallizes from alcohol in small white needles, aggregated into hemispherical rosettes.

Compound with Dimethylaniline.

Mercuric chloride, $2C_6H_5(CH_3)_2N.HgCl_2$.—One molecule of mercuric chloride was added to two molecules of dimethyl-aniline, the temperature of the mixture rising from 21° to 44°. The solid mass formed on cooling was thoroughly washed with alcohol and was left as a greenish-gray powder.

Compound with Naphthylamine.

Mercuric chloride, $2C_{10}H_9N.HgCl_2$.—After fusion of the naphthylamine, and addition of the mercuric chloride, the temperature of

the mixture rose from 61° to 67°. The resulting mass was washed repeatedly with alcohol without becoming white, but it crystallized from boiling ligroine in minute white needles, turning brown in contact with the air.

Note on Thiocarbanilide.

It was found that the compound $2C_6H_7N.HgCl_2$ underwent rapid decomposition when exposed in contact with carbon disulphide to the action of sunlight. Subsequently, that this decomposition took place merely by heating, and could be best effected in the following manner:

The purified chloride of diphenylmercurammonium was dissolved in alcohol, and after being mixed with carbon disulphide, was boiled for several days under a return cooler. When the reaction was finished, which was made evident by the clearing of the liquid, the precipitated HgS was filtered off, and the filtrate set aside to crystallize.

After a second crystallization, a pure product was obtained with a melting point of 144°, and which proved on analysis to be thiocarbanilide, $C_{13}H_{12}N_2S$.

	Found.	*Theory.*
Carbon	68.31	68.42
Hydrogen	5.41	5.26
Sulphur	14.00	14.04

Thiocarbotoluidide and thiocarboxylidide were formed in the same manner from $2C_7H_9N.HgCl_2$ and $2C_8H_{11}N.HgCl_2$.

The cyanide of diphenylmercurammonium also yields thiocarbanilide when boiled with carbon disulphide, hydrocyanic acid escaping.

Thiocarbanilide is ordinarily prepared by boiling aniline and alcoholic potash with an excess of carbon disulphide.

XXXV.—Analysis of Beet Root and Sorghum Cane.

By P. Casamajor.

In the United States, for the last twenty years, many attempts have been made to manufacture sugar in a commercial way, from beet root and from the sorghum cane. Such attempts continue to be made at this day, and although there is no predicting what results

may be obtained in the future, I believe that heretofore these attempts have not been successful.

There are many persons who believe that cane sugar can be made commercially from the sorghum cane, while others believe that beet root is preferable to sorghum. The partisans of beet and those of sorghum differ widely in their estimates of the comparative values of these two sources of sugar. There is only one way of settling the question, which is to produce beet or sorghum which will yield good results. I have had occasion to examine several samples of beet root raised in the Northern States, and one of sorghum, and the results obtained were in all cases very unfavorable.

The object of this communication is to call attention to the processes by which we may ascertain beforehand the quantity of sugar which may be obtained from a given weight of beet root or of sorghum cane. It is nearly useless to try to ascertain the yield of a saccharine juice by experiments on a small scale, as such experiments never yield results analogous to those which can be obtained on a large scale with improved apparatus.

Beet root or sorghum cane can only be considered by the sugar manufacturer as so much raw material. To estimate the value of either, the manufacturer should follow exactly the course that a refiner follows to ascertain the commercial value of a raw sugar. A refiner knows that, from a given quantity of raw sugar, he can obtain a certain portion of pure or nearly pure sugar, and a certain quantity of molasses which will not yield any crystallizable sugar. Therefore, if he can ascertain the total quantity of sugar in raw sugar, and the portion which will remain in the molasses, the difference will be the pure sugar which he will obtain in refining.

It may be urged, that account should also be taken of a certain quantity of sugar lost during the process of refining, but this loss is due to causes entirely independent of the composition of any raw sugar under examination, and it should be left out of the calculation.

The composition of molasses from a well regulated sugar-house is pretty nearly constant. If raw cane sugars are used in a refinery, the composition of the molasses which will not yield any sugar crystals will be very nearly as follows for a syrup of density equal to 40° Baumé :

Sugar	37.5
Soluble impurities	37.5
Water	25.0

A refiner may obtain, as residue, a syrup containing a smaller percentage of sugar, but we may assume, for the purpose of comparing one sample of raw sugar with another, that the above will be the composition of the molasses obtained in refining.

For the sake of convenience in comparing one product with another in a sugar refinery, the composition of each product is sometimes stated *in the dry state*, or on the supposition that the product contains no water. Water is easily added, and it may be taken away by evaporation without affecting the quantity of pure sugar obtainable from a given commercial sugar. The quantity of sugar in a product reduced to dryness, compared to the total substances, is called *coefficient of purity* or *quotient of purity*.

Referring to the composition of the sugar-house molasses given above, we may see that its *coefficient of purity* is 50, which means that in cane sugars 1 per cent. of soluble impurities prevents the crystallization of 1 per cent. of sugar.

It has been argued that the coefficient of purity of molasses is not a safe guide for calculating the yield of pure sugar from a given sample of raw material.

There would be some foundation for this if the coefficient of purity of the molasses of a given refinery varied within very wide limits. The contrary is, however, the case. Thousands of tests, extending through several years, have convinced me that the coefficient of purity of molasses may be kept within very narrow limits. The coefficient is not always 50. Some refiners prefer to keep it somewhat lower; but the coefficient 50 answers very well for calculating the quantity of pure sugar obtainable from a raw cane sugar.

To apply the above, let us suppose that we have a raw sugar whose coefficient of purity is 92. The composition of the sugar, supposed dry, would be:

Sugar	92
Impurities	8

As 8 parts of impurities prevent the crystallization of 8 parts of sugar, the yield of the above dry sugar would be $92 - 8 = 84$ per cent.

The results which can be obtained from a given weight of beet root sugar are somewhat different from those which cane sugar will afford. A series of tests made in the principal sugar refineries of Paris show that the coefficient of purity of beet molasses seldom goes below 52, and is generally 55. From this we may deduce the rule that in beet root sugar 1 per cent. of impurities prevent the crystallization of 1.2 per cent. of sugar.

The composition of sorghum molasses, from which all the crystallizable sugar has been separated, has not been ascertained, as far as I know. From the analogy between sorghum and the sugar cane we may assume that, for sorghum sugar, 1 per cent. of soluble impurities prevents the crystallization of 1 per cent. of sugar.

The difficulty with beet root and sorghum cane grown in this country is principally that the coefficient of purity of their juices is not sufficiently high. Whenever a product is obtained whose coefficient of purity is high enough, the quantity of juice in a certain weight of roots or of cane may be ascertained, and this presents no difficulty. If, however, the coefficient of purity is not sufficiently high, there is no use in making further determinations, as there cannot be any profit in working a juice of low grade.

The coefficient of purity of a juice is determined very quickly and accurately by using a process which I first described in the *American Chemist* for October and November, 1873. This process is described more fully and in better form in the *Moniteur Scientifique* for March, 1877. In a late book on sugar analysis, published by Van Nostrand, it is said that this process is advisable when a balance is not at hand, but that it does not give as satisfactory results as Balling's process, which is mentioned as the *direct* process.

As my process is in use in most of the important refineries in the United States, I do not feel called upon to defend it. A constant use of it for several years shows that the results it gives agree within at least 1 per cent., and generally within less than $\frac{1}{2}$ per cent. This process is founded on this: That the pure sugar in 100 c.c. of a solution is given by multiplying the indication of the optical saccharometer by 0.26048 when a Ventzke instrument is used, or by 0.1635 for the Duboscq saccharometer. On the other hand, the total quantity of substance in solution is represented by the degree Balling, multiplied by the specific gravity.

The coefficient of purity is obtained by dividing the first product by the second. If we call the saccharimetric test S, the specific gravity P, and the Balling degree B, we shall have—

$$\text{Coefficient of purity} = \frac{S \times 0.26048}{B \times P}$$

This may be written:

$$S \times \frac{0.26048}{B \times P}$$

If for every degree Balling we calculate the quantity

$$\frac{0.26048}{B \times P}$$

we may form a table of factors by which to multiply the saccharimetric degree to obtain the coefficient of purity of a solution.

We may, instead of the Balling degree, determine the specific gravity, and for any specific gravity use the factor corresponding to

$$\frac{0.26048}{B \times P}$$

In the articles above referred to, tables are given for Balling degrees between 5° and 15°, and for Geisler's specific gravity spindle, ranging from 1.095 to 1.1050. For any other degree Balling, or any other specific gravity, the factors may be easily calculated from the formula given above.

The specific gravity may be determined by a balance, and the factor may be obtained by the following formula, in which the Balling degree does not enter :

$$\frac{0.1}{P - 1}$$

in which P is the specific gravity. This is for Ventzke's instrument For the Duboscq saccharometer, the factor is given by

$$\frac{0.0628}{P - 1}$$

To test a lot of beets for coefficient of purity, the juice should be taken so as to represent the average juice of the lot. A wedge-shaped piece should be cut out of every root picked out for analysis. The thin edge of the wedge should be at the axis of the root, and the angle of each wedge should be the same for every piece. All the wedges may be rasped on a common grater, and the pulp obtained should be pressed in a cloth so as to obtain the juice. This is immediately neutralized with lime, and heated, by which a thick black precipitate is obtained. The liquid, after filtration, is light and clear enough to be placed in the tube of the optical saccharometer. The density of the filtered liquid should be taken to determine the coefficient of purity, as the juice of beets can always be defecated with a little lime.

The juice of sorghum cane is easily obtained by crushing with a hammer and wringing the cane with the hands, if no special apparatus is at hand.

If the coefficient of purity of a juice is sufficiently high, we may in the next place determine the quantity of juice in a certain weight of the raw material.

The quantity of juice in the pulp obtained by rasping may be got at by drying a certain weight of the pulp and determining the water in the pulp by loss. We also determine the water in the juice by taking the difference between 100 and the Balling degree. As all the water in the pulp is in the juice, we have:

$$\text{per cent. juice in the pulp} = \frac{\text{per cent. of water in the pulp.}}{\text{per cent. of water in the juice.}}$$

As to what constitutes a sufficiently high coefficient of purity, this should be left to the judgment of the parties interested. I may, however, call to attention that in the North of France in 1879, a beet was not considered as fit to work for sugar, the coefficient of purity of whose juice was below 79. For 100 parts of dried juice the composition would be:

Pure sugar	79
Impurities	21

We have seen that in beet juice 1 part of impurities prevents the crystallization of 1.2 parts of sugar, therefore the yield would be:

$$79 - (21 \times 1.2) = 79 - 25.2 = 53.8 \text{ per cent.}$$

I have had occasion to analyze several samples of beet roots grown in the United States. Those which gave the highest coefficient of purity were from Delaware, the coefficient of purity of the juice being 63 per cent. The yield of sugar of the dried juice would be

$$63 - (37 \times 1.2) = 63 - 44.4 = 18.6 \text{ per cent.}$$

Most of the beet roots I tested had a coefficient of purity below 50, and they could not, therefore, yield any sugar.

The coefficient of purity of the juice of a sorghum cane which I tested lately was 44, and of course no sugar could be obtained from this juice.

It is almost unnecessary to state in conclusion, that the processes described are applicable to the sugar cane, and to other plants with saccharine juices.

Reports on American and Foreign Patents Relating to Chemistry.

American Patents.

Condensed from the Official Gazette of the **U. S. Patent Office**, by ARNO BEHR.

May 3, 1881.

240,846.—*Process of melting and purifying glass.* JACOB REESE.

240,855.—*Manufacture of glue.* FRIEDRICH SELTSAM and RICHARD HAGEN.

240,879.—*Process of purifying saccharine liquids of low grades.* ARNO BEHR, OTTO H. KRAUSE, and HENRY E. NIESE.

The solutions diluted to about 15° Bé are treated with lime and slightly heated, the flocculent precipitate is removed by filtration, and the caustic lime contained in the filtrate saturated with carbonic acid, and the liquid heated and filtered. The first and second precipitates contain considerable amounts of coloring and other organic matters.

240,936.—*Apparatus for, and process of, cooling and refining oil.* WM. G. WARDEN.

Air which has been dried with sulphuric acid, and cooled, is driven through the oil.

240,941 and 240,942.—*Manufacture of artificial indigo.* ADOLPH BAYER.

Two methods for the artificial production of indigo, the first from isatine chloride with glacial acetic acid and zinc dust, the second from isatine with phosphortrichloride, acetylchloride, and yellow phosphorus.

241,056.—*Manufacturing artificial wool from vegetable fiber.* MICHAEL NEUMANN.

241,070.—*Photographic paper.* THOMAS C. ROCHE.

May 10, 1881.

241,163.—*Blasting powder.* TRUE P. SLEEPER.

Chlorate of potash, sugar, and charcoal.

241,164. *Process of smelting ores containing iron and precious metals.* HENRY A. SPEARS.

Mixing the ores with lead or lead-ores, and separately tapping off the pig-iron and base bullion.

241,172.—*Centrifugal machine for creaming milk.* DAVID M. WESTON.

241,202.—*Manufacture of glucose.* AMBROSE G. FELL.

The inventor claims the use of nitric acid together with sulphuric acid for conversion; conversion at a temperature below the boiling point of water; use of sulphurous acid gas in the vacuum pan.

241,203.—*Filtering tank.* AMBROSE G. FELL.

241,207.—*Treating sorghum or ribbon cane.* WILLIAM L. GEBBY.

The cane is scalded with steam and then dried.

241,216.—*Process of fusing and moulding iridium.* JNO. HOLLAND.

"Raising the metal to a high heat, then adding to it phosphorus, and after the metal is cast releasing the phosphorus by subjecting the metal to heat in a chalk bath."

241,383.—*Perfumed caustic soda.* GEORGE T. LEWIS.

Add from 10 to 30 drops of an essential oil to every pound of granulated or pulverized caustic soda.

241,398.—*Mordant.* SAMUEL MELLOR.

"Stibio-fluorine salts."

241,463.—*Manufacture of fertilizers from blood.* RICHARD WERDERMANN.

"Adding lime to the fresh blood, agitating the mixture, next precipitating the lime, and finally drying the coagulated blood."

May 17, 1881.

241,476.—*Treating cereals to separate the oily germs, flour, and starch for the use of distilleries, etc.* FERDINAND CAMUS.

Maize is soaked in a solution of a sulphite or bisulphite, and afterwards treated with a dilute mineral acid. To the sulphurous acid liberated in this way within the grain and which is called nascent sulphurous acid, the inventor ascribes a peculiar action on the grain, which facilitates a subsequent separation of the germs and hulls from the mealy part of the grain.

241,505.—*Jellifying petroleum and other substances insoluble in water.* CYPRIEN TESSIÈ DU MOTAY, AUGUSTE J. ROSSI, ALEXANDRE BOURGOUGNON, and PAUL CASAMAJOR.

The process consists in adding petroleum gradually, while agitating, to a solution of gelatine.

241,570.—*Process of lining Bessemer converters or other furnaces, and the preparation of lime used therefor.* SIDNEY G. THOMAS and PERCY C. GILCHRIST.

241,655.—*Lactometer.* FRIEDRICH HEEREN.

The color of a thin layer of milk viewed against a black background is compared with a scale of colors conveniently arranged.

241,661.—*Dyeing colors on cotton or textile fabrics.* THOMAS and ROBERT HOLLIDAY.

Azocolors produced by the action of phenoles upon diazo compounds are developed directly upon the cloth by impregnating it with the two solutions in succession.

241,677.—*Process of preserving organic substances.* CHARLES F., ARTHUR W., and ALBERT L. LAWTON.

Fruits are placed in large receptacles, which are then filled with a mixture of nitrogen and carbonic oxide.

241,713.—*Method of preparing paper for reproducing drawings and designs.* HENRI PELLET.

The paper is impregnated with a mixture of a ferric salt and citric acid, and covered with the drawing to be reproduced, exposed to the action of light. Subsequent washing with a solution of yellow prussiate of potash develops the design in blue lines.

241,718.—*Process of manufacturing solid steel castings.* JACOB REESE.

241,738.—*Manufacture of artificial chinoline.* ZDENKO H. SKRAUP.

Chinoline is produced by heating a mixture of nitrobenzole, aniline, glycerine, and sulphuric acid.

241,772.—*Process for the treatment of flax-seed.* HOMER T. YARYAN.

Moistens the seed before it is extracted, with naptha.

May 24, 1881.

241,810.—*Composition of matter for the manufacture of illuminating candles.* RICHARD F. W. LOPER.

Wax, carbon oil, and animal charcoal.

241,868.—*Treating phosphates for fertilizers.* GUSTAV A. LIEBIG.

"Treating phosphates by mixing them with carbon and subjecting them to heat, for fertilizing purposes."

241,897.—*Manufacture of size.* EMIL R. VON PORTHEIM.

Coagulated or insoluble albuminoid substances are dissolved in an alkali, and the excess of the latter is neutralized with muriatic acid.

241,903.—*Process of manufacturing crystallizable grape sugar.* HORACE WILLIAMS and JOHN L. ALBERGER.

Corn is treated with hot dilute acid, and the resulting saccharine liquid is treated in the usual way until the final concentration, after which the inventors claim to have added the following steps, viz.: cooling of the concentrated syrup, adding a small percentage of powdered grape-sugar, and pressing the mass after crystallization.

241,941.—*Method of preparing nitro-glycerine compounds.* GILBERT S. DEAN.

100 pts. nitro-glycerine, 10 pts. of pulverulent nitro-cellulose, and 2 to 3 pts. water.

241,958.—*System of malting, and apparatus employed therein.* NICHOLAS G. GALLAND.

242,015.—*Process of, and apparatus for, distilling turpentine.* JAMES A. MCCREARY.

242,080.—*Dyeing fibrous material.* H. W. VAUGHAN.

"Mechanically incorporating with the fibrous material during the process of manufacture, a mordant, by the aid of infusorial earth or other suitable vehicle for the same, and an oleaginous constituent, and afterward causing the dye-stuff and mordant to chemically combine to form a fast color, by heating or steaming the material."

May 31, 1881.

242,171.—*Process of, and apparatus for, bleaching and purifying liquid bituminous matter.* VICTOR VON OFENHEIM and RUDOLPH VON HAIDINGER.

Filtration through earthy substances.

242,216.—*Process of evaporating, crystallizing and refining saccharine solutions and producing dry refined sugar.* JAMES A. MORRELL.

Cane-juice is subjected to a series of operations in which "deoxidized and electrized" air plays an important part.

242,263.—*Nickel-plating fluid.* GEORGE BRUCKER.

Nitrate of nickel, hyposulphide of soda, and cream of tartar.

242,272.—*Treatment of the saline liquors resulting from soap-manufacture, in order to extract the matters contained therein.* CONSTANT V. CLOLUS.

242,337.—*Process of silvering glass.* CONSTANT LAVAL.

Two solutions of nitrate of silver, water, and aqua-ammonia, and of nitrate of silver, water, potassa, and pyroxyline, are mixed and immediately poured upon the glass surface to be silvered.

242,368.—*Process of, and apparatus for, drying air.* GEORGE H. REYNOLDS.

Air is forced, under strong pressure, through water. The latter cools it and takes up the excess of moisture from the air.

June 7, 1881.

242,439.—*Saccharification of amylaceous matters by malt.* AUGUSTE P. DUBRUNFAUT.

A process for the production of crystallized maltose from starch with malt, the activity of the latter of which has been increased by "oxidizing its infusion."

242,546.—*Process of manufacturing and purifying gas for preserving purposes.* CHARLES F., ARTHUR W., and ALBERT L. LAWTON.

Refers to No. 241,677.

242,589.—*Method of treating hominy for preservation.* WILLARD S. BOON.

Hulled corn is wetted with a weak alkaline solution and then dried.

242,624.—*Process of coating metals with lead, zinc, or tin.* WM. FRISHMUTH.

Iron is first nickel-plated, and then immersed into the molten metal.

242,702.—*Apparatus for separating and recovering the fatty matters from bones.* FRIEDRICH SELTSAM.

242,707.—*Azo-color.* JAMES H. STEBBINS, JR.

The product of the reaction of mono-sulpho acid of betanaphthol on a mixture of diazobenzole and diazonaphthalene.

June 14, 1881.

242,783.—*Explosive compound.* JOHN M. LEWIN.

Nitro-glycerine, cellulose, and nitre.

242,855.—*Dyeing fabrics with aniline colors.* NICHOLAS C. ARMAND and JACQUES E. BERTON.

Aniline colors are made soluble in benzine by the admixture of oil.

243,000.—*Method of dyeing leather black.* NIELS G. SOERENSEN.

Tanned leather is treated with a vanadium salt.

June 21, 1881.

243,062.—*Preserved wood.* JOS. H. CONNELLY.

Wood saturated with a solution of sulphate of ammonia.

243,141.—*Dyeing mixed fabrics.* JULES J. LELOIR.

A mordant of a complex composition.

243,178.—*Process of manufacturing an inspissating and sizing paste from animal proteine.* EMIL VON PORTHEIM.

Insoluble albuminoid substances treated with caustic alkali.

243,233.—*Filtering liquids and apparatus therefor.* JOHN F. C. FARQUHAR and WALTER OLDHAM.

243,265.—*Filter.* JOHN W. HYATT.

243,310.—*Process of separating gypsum from the solutions of starch sugar produced by treating the latter with sulphuric acid.* CARL SCHEIBLER.

If a grape-sugar solution, containing sulphate of lime, is boiled with oxalate of barium, two insoluble compounds, oxalate of lime and sulphate of barium, are formed.

June 28, 1881.

243,377.—*Process of manufacturing fatty acids for making candles.* ARMAND MUELLER JACOBS.

243,378.—*Turkey-red mordant.* ARMAND MUELLER JACOBS.

243,428.—*Galvanic battery.* JOSEPH H. CHEEVER.

243,432.—*Explosive compound.* SILAS R. DEVINE.

Chlorate of potash and nitro-benzole.

243,510.—*Process of obtaining perfume of natural flowers and apparatus therefor.* ROBT. A. CHEESEBROUGH.

The absorbing material is placed on trays in a closed compartment which also contains the flowers.

242,635.—*Manufacture of aluminous cake.* CONRAD SEMPER.

Aluminous sulphate, in a semi-fused condition, is treated with zinc-dust.

243,669.—*Method or process of manufacturing glucose from grain.* HORACE WILLIAMS and JOHN L. ALBERGER.

The inventors claim "the process of washing off and eliminating the impurities of crystallized grape-sugar, by pressure or centrifugal force."

243,673.—*Method of treating copper ores containing precious metals.* PAUL G. L. G. DESIGNOLLE.

July 5, 1881.

243,685.—*Gelatine prepared in the form of dried foam.* REUBEN BROOKS.

A foam produced from the solution by blowing air into it is dried in a current of dry air.

243,757.—*Manufacture of soap.* PAUL CASAMAJOR.

Ordinary soap is melted, and while it is rapidly agitated, spirits of turpentine or heavy oil of petroleum is added, when the whole combines to a uniform mass, which hardens on cooling.

243,789.—*Method of, and composition for, lining plumbago crucibles.* JOHN PEDDER.

The crucibles have a glaze composed of plumbago, silica, salt, and clay-water.

243,827.—*Manufacture of lactates.* CHAS. E. AVERY.

"Manufacturing lactic acid by the fermentation of a sugar of vegetable origin with a lactic ferment in the presence of nitrogenous matters, chiefly of vegetable origin, and of a substance suitable to gradually neutralize the acid as fast as formed."

243,850.—*Furnace for the reduction of zinc, cinnabar, and other ores.* SAMUEL G. CLARK.

243,910.—*Process of manufacturing distilled spirits from grain.* THOMAS A. and WILLIAM T. JEBB.

Corn is steeped, ground, and beaten. It is then sifted with water and separated into a finely-disintegrated portion which passes through the sieve and into another portion which is retained on the sieve, and which the inventors call "bran and gluten." Only the former is to be used in the manufacture of alcohol.

243,923.—*Tanning process.* ROBERT KOENITZER.

243,936.—*Soap.* ROBERT A. MCCULLOUGH.

243,939.—*Grinding and sieving caustic alkali.* WILLIAM G. MENZIES.

It is done while the substance is still hot.

243,949.—*Manufacture of sulphate of alumina.* BENJAMIN E. R. NEWLANDS.

The sulphate of alumina is allowed to crystallize, and the mother-liquor containing the impurities is removed by pressure or centrifugal force.

243,963.—*Treatment of horn shavings.* JULIUS PATHE.

They are treated with boracic and arsenious acids, and then heated to 120° C.

243,991.—*Manufacture of soda.* ERNEST SOLVAY.

"Mixing soda with the bicarbonate of soda previous to the introduction of the bicarbonate into the decomposing apparatus."

July 12, 1881.

244,080.—*Composition for dissolving the coating of gold in ore.* JOHN F. SANDERS.

Cyanide of potassium and phosphoric acid.

244,234.—*Electro-deposition of metal.* PAGET HIGGS.

Refers to the production of aluminium from its borate by galvanic deposition.

July 19, 1881.

244,421.—*Means for extinguishing fire in oil-tanks.* CHAS. BARNES.

244,445.—*Process of producing alloys for anodes.* WILLIAM FRISHMUTH.

Refers to the production of an alloy of nickel and aluminium.

244,674.—*Preparing and bleaching jute.* JOSEPH J. SACHS.

July 26, 1881.

244,757.—*Coloring matter from tetranitro-naphthol.* EMIL LABHARDT.

By the energetic action of nitric acid on monobromnaphthalene tetranitro-naphthol is produced.

244,788.—*Treating caoutchouc with hydrocarbon oils.* LUDWIG BECKERS.

A solution of caoutchouc in a "hydrocarbon oil" of 250–300° C. boiling point is used for waterproofing.

244,872.—*Method of, and apparatus for, manufacturing artificial leather.* EWALD FISCHER.

244,875.—*Galvanic battery.* JOHN H. A. and ANTON H. B. FOLKERS.

244,902.—*Production of saccharine substances.* S. H. JOHNSON.

The inventor's process of treating grain which has been impregnated with dilute sulphuric acid in a peculiarly constructed converter,

with steam of high pressure, has been found to be also applicable to brewers' or distillers' grains for the production of saccharine solutions therefrom.

August 2, 1881.

245,226.—*Distilling, condensing, and refrigerating apparatus.* DÉSIRÉ F. SAVALLE.

August 9, 1881.

245,274.—*Mechanism for, and process of, extracting oil from oleaginous materials.* FRANCIS H. BYERLEY.

245,411.—*Phosphorescent composition.* MERRILL B. SHERWOOD.

Sulphides of calcium combined with carbonate of lime, magnesia, and silex.

245,568.—*Apparatus for testing hydrocarbon fluids.* GEORGE M. SAYBOLT.

August 16, 1881.

245,633.—*Process of manufacturing oleaginous mordants.* ARMAND MUELLER JACOBS.

245,661.—*Manufacture of potassium ferrocyanide.* THEODOR RICHTERS.

Nitrogenous substances are impregnated with a solution of carbonate of potassium dried in an atmosphere of carbonic acid and then calcined in retorts. The mass is afterwards boiled in contact with iron.

245,701.—*Thickener for mordants and colors.* JOHN BURTON.

The substance recommended is glucose.

245,750.—*Manufacture of sulphate of alumina.* CONRAD SEMPER.

The impure solution is in the form of a spray treated with sulphurous acid, or sulphuretted hydrogen, in order to reduce ferric sulphate.

245,809.—*Manufacture of sugar.* EMIL FLEISCHER.

Refers to the recovery of sugar from beet-root molasses by means of a bibasic saccharate of strontia.

245,853.—*Ingredient scale.* WILLIAM J. MILLER.

August 23, 1881.

245,952.—*Manufacture of plastic compounds from pyroxylene.* SAMUEL J. HOGGSON and GEORGE C. PETTIS.

The pyroxylene to be used is treated with sal-ammonia in order to render it less explosive.

245,955.—*Manufacture of soap.* BENNO JAFFÉ and LUDWIG DARMSTAEDTER.

The process of salting soaps with sulphate of soda for the purpose of obtaining a waste lye from which glycerine is produced.

246,075.—*Purifying vegetable oils, and separating them from solvents.* FRANCIS H. BYERLEY.

First steam and then air is blown through the heated oil.

246,096.—*Process of solidifying crude and refined petroleum.* PETER DITMAR.

Two to three per cent. of tallow-soap are to be dissolved in the oil.

246,201.—*Electro-chemical treatment of ores.* EMILE REYNIER.

The object is to recover certain metals from their ores, and at the same time to generate electricity for general application.

246,221.—*Azo-color.* JULIUS SCHUNCKE.

The product of the reaction of diazo-azoxylole upon betanaphtholedisulpho acid, called ärchil-red.

246,242.—*Treatment of tank waters of slaughterhouses, etc.* BRUNO TERNE.

These waters are to be concentrated, mixed with sulphuric acid, and this mixture used for the treatment of phosphatic substances for the production of a fertilizer.

246,262.—*Method of, and process for, manufacturing glucose from grain.* HORACE WILLIAMS and JOHN L. ALBERGER.

Grain is boiled with very weak acid just long enough to render all the starch soluble. The liquid is then separated by filtration, and by adding more acid and boiling the conversion is completed.

246,272.—*Azo coloring-matter.* HEINRICH BAUM.

The product of the reaction of diazobenzoïesulpho acid upon betanaphtholemonosulpho acid.

August 30, 1881.

246,327.—*Methyl-blue color.* CARL A. MARTINS.

The dye-stuff is produced by reducing "methyl-orange No. 3" with sulphohydrate of ammonia, and oxidizing it afterward with perchloride of iron

246,396.—*Apparatus for concentrating sulphuric acid.* CÆSAR KOLBE and THEODOR LINDFORS.

246,398.—*Method of dephosphorizing crude cast-iron.* LOUIS G. LAUREAU.

246,532.—*Lubricating compounds for car-axles, etc.* GEORGE H. MERRILL.

Tallow, rosin, petroleum-tar, milk of lime, and graphite.

September 6, 1881.

246,614.—*Compound hydrocarbon fuel.* JOHN P. JONES.

Infusorial earth impregnated with petroleum.

246,616.—*Desiccating machine.* CORNELIUS KIMPLEN.

246,762.—*Preserving wood.* ERWIN HAGEN.

Uses a solution of chloride of zinc and sulphate of lime in water.

246,793.—*Process of distilling alcohol.* CHARLES W. LAWRENCE.

Adds powdered charcoal to the fermented mash before distilling.

246,816.—*Method of utilizing the residue of the acid treatment of grain and other materials for the manufacture of alcohol.* EUGENE PORION and LOUIS MEHAY.

"Subjecting said residue to pressure in filter-presses and obtaining therefrom both oil and oil cake."

September 13, 1881.

246,891.—*Treatment of pyroxylene.* CHARLES S. LOCKWOOD.

It is mixed with a solution of camphor in chloral.

246,900.—*Process of obtaining pure juice from sugar-cane.* WILLIAM A. MARTIN.

The cane properly sliced is treated with steam in a closed vessel, and the remaining juice washed out with water.

246,908.—*Process of producing a metal high in phosphorus and carbon and low in silicon.* JACOB REESE.

246,949.—*Apparatus for the continuous distillation of ammonia.* HERMANN GRUENEBERG and JACOB GAREIS.

246,958.—*Polishing composition.* ALEXANDER LEVETT.

Uses glucose as a base for holding the polishing materials.

247,046.—*Process of, and apparatus for, making ammonium sulphate.* HUBERT GROUVEN.

247,083.—*Process of manufacturing carbons.* HIRAM S. MAXIM.

Heats carbonized strips to be used in electric lamps by an electric current in an atmosphere of naphtha vapor in order to stiffen and strengthen them.

September 20, 1881.

247,152.—*Process of treating corn in the manufacture of starch, glucose, and other products therefrom.* ARNO BEHR.

This process is based on the fact that, by a proper treatment of steeping, crushing, and disintegrating, the germs of corn are obtained almost unbroken and free from the mealy parts and the hulls. If then sufficient water is added to bring the mixture of meal and water to about 10° Bé density, the germs rise to the top while the hulls sink. The process is conducted in a special apparatus which effects a continuous separation of the substance of the corn into germs, hulls, and mealy parts.

247,271.—*Method of making lime brick.* JACOB REESE.

Uniting the particles of indurated lime by the use of a fluid silicate of lime.

247,288.—*Process of manufacturing sugar.* JOHN L. ALBERGER.

Corn is treated with water and steam under pressure until all the starch is liquified. The solution is separated from the insoluble residue by filtration, and then converted in the usual way.

247,388.—*Method of filtration.* GEORGE F. MEYER.

Filtration of saccharine solutions through granular mineral substances instead of through charcoal.

247,455.—*Method of treating grape-sugar or glucose for the purpose of refining the same.* HORACE WILLIAMS and JOHN L. ALBERGER.

The inventors propose to eliminate the bitter and other impurities of raw grape-sugar solutions by fermentation. The specification omits to state how this fermentation is to be conducted.

September 24, 1881.

247,494.—*Hardening copper.* ANNIE GETCHELL.

Addition of a compound of potash, alum, bone-dust, and zinc.

247,804.—*Centrifugal creamer.* GUSTAF DE LAVAL.

247,834.—*Manufacture of hard rubber.* THOMAS J. MAYALL.

Mixing pure rubber with sulphide of antimony, and curing the compound by heat.

247,957.—*Refining starch sugar.* FRANZ SOXHLET.

The process of refining consists in treating impure grape-sugar with, or recrystallizing it from, methyl or ethyl alcohol, and removing the alcoholic solution containing the impurities, by pressure or centrifugal force. If a concentrated solution of the purified grape-sugar is allowed to solidify at a temperature above 30° C., hydrate of grape-sugar of a distinct crystalline structure is obtained.

247,958.—*Refining and crystallizing starch sugar.* FRANZ SOXHLET.

Crystallized anhydrous grape-sugar is produced from a solution of grape-sugar in methylic alcohol.

October 11, 1881.

248,041.—*Yeast.* WILLIAM H. HIGGINS.

Adds glycerine to the mixture of yeast and starch.

248,153.—*Process of preparing leuco-base of aniline-blue.* OTTO FISCHER.

The process consists in making para-amidobenzaldehyde react upon a mixture of diphenylamine and methyldiphenylamine in the presence of chloride of zinc.

248,154.—*Process of preparing coloring matter.* OTTO FISCHER.

If para-amidobenzaldehyde is made to react upon a mixture of aniline and toluidine the leuco-base of rosaniline is produced.

248,183.—*Apparatus for meteorology.* WILHELM KLINKERFUES.

248,246.—*Coloring matter.* OTTO N. WITT.

A violet dye formed by the action of nitrosodimethylaniline on metaphenylenediamine.

October 18, 1881.

248,313.—*Glucose.* FRANK HIGEL.

The root of the plant manihot is used for the manufacture of glucose.

248,314.—*Manufacture of soap.* CHARLES S. HIGGINS.

248,343.—*Process of, and apparatus for, cleansing meal from which oil has been extracted.* RAYMOND S. PERRIN.

248,413.—*Compound of celluloid and luminous material.* ISAAC W. DRUMMOND.

Celluloid and sulphide of calcium.

248,425.—*Apparatus for producing high vacuums.* THOMAS A. EDISON.

248,431.—*Preserving fruit.* THOMAS A. EDISON.

The fruit is placed in a glass vessel which is sealed by fusion after a high vacuum has been produced.

October 25, 1881.

248,606.—*Apparatus for collecting waste hydrogen in the manufacture of iron wire.* RICHARD N. R. PHELPS.

248,632.—*Process of purifying gas.* FRANCIS J. BOLTON and JAMES A. WANKLYN.

Dry superphosphate is used in which the free acid has been neutralized with ammonia-water.

248,654.—*Secondary electric battery.* PAUL JABLOCHKOFF.

248,674.—*Manufacture of annealed, hardened, and toughened glass articles.* FREDERICK SIEMENS.

248,768.—*Filter.* JUAN F. N. MACAY.

248,769.—*Electrophore, or secondary battery.* JAMES A. MALLONEY.

248,797.—*Method of preserving milk.* GUSTAV ROTHE.

The caseine is coagulated by addition of lactic acid, the clear liquid evaporated to dryness and mixed with the dried caseine.

248,800.—*Apparatus for treating mineral and other substances with acids.* AMÉDÉE M. G. SÉBILLOT.

248,833.—*Compound for the desulphuration of liquids and gases.* FRIEDRICH LUX.

"Artificial peroxide of iron combined with alkalies."

November 1, 1881.

248,904.—*Gum substitute.* GEORGE F. WILSON and PHILIP O'REILLY.

In the manufacture of dextrine from starch, hydrochloric acid is used instead of nitric acid, and the material kept flowing in a continuous stream and agitated while being roasted.

248,972.—*Manufacturing glucose or grape-sugar.* HORACE WILLIAMS and JOHN L. ALBERGER.

"Grinding the corn wet, then washing and separating the starch from the husk, then taking it directly from the separator to the cooker, converting it into dextrine and filtering it before saccharification."

249,136.—*Production of coloring matter.* OTTO N. WITT.

A dark-red dye formed by the action of nitrosodimethyl aniline on metatoluylenediamine, belonging to a class of coloring matters called indophenols by the inventor.

November 8, 1881.

249,161.—*Apparatus for making vinegar.* JAS. CUSHING.

249,420.—*Process for manufacturing phosphorescent substances.* ORLANDO THOWLESS.

November 15, 1881.

249,490.—*Explosive compound.* CARL W. VOLNEY.

A mixture of monochlordinitrine and nitrate of potassium.

249,506.—*Manufacture of soap.* MIGUEL DE LA VEGA and LUIZ D'OLIVEIRA.

Castor-oil soap.

249,548.—*Preparing, indurating, and solidifying calcareous lining materials for furnaces.* JACOB REESE.

Melts the carbonates of lime or magnesia under sufficient pressure to prevent the escape of the carbonic acid.

249,701.—*Explosive compound.* THOMAS VARNEY.

249,731.—*Apparatus for separating fluids.* GUSTAF DE LAVAL.

November 22, 1881.

249,856.—*Preserving wood.* SAMUEL R. PERCY.

A solution containing a resinous gum and picric acid is used.

249,936.—*Coloring matter.* JOHANNES H. H. O. GUERKE.

"Produced by the action of the disulphobetanaphtholic sodium salt, insoluble in alcohol, on the diazoic derivative of para-amidocinnamic acid methylic ether."

250,009.—*Lubricating compound.* EDMUND SMALLEY.

Tallow, pine-tar, and sulphur.

250,035 and 250,036.—*Manufacture of artificial indigo.* ADOLPH BAEYER.

Orthonitrophenylpropiolic ether, on reduction with sulphhydrate of ammonium, gives indogenic ether, from which indogenic acid can be obtained by treatment with caustic alkali. Indogenic acid, under the influence of heat, is transformed into indogen. Both these substances can be used for the production of indigo-blue.

250,038.—*Manufacture of crimson coloring-matter.* HEINRICH BAUM.

It is produced "by the action of the disulpho betanaphtholic sodium salt, insoluble in alcohol, on the diazoic derivative of amido-paracreosote-methylic ether."

November 29, 1881.

250,071.—*Process of manufacturing albumen.* UNO H. HILLMANN.

Crushes fish-spawn with water and evaporates the solution under a vacuum at a temperature low enough to prevent coagulation.

250,117.—*Manufacture of glucose.* HENRY A. WEBER and MELLVILL A. SCOVELL.

The application of the seeds of the sorghum plant to the manufacture of starch and sugar.

250,118.—*Process of manufacturing sugar and syrup.* HENRY A. WEBER and MELVILL A. SCOVELL.

The process refers to the treatment of sorghum-juice, which consists in exactly neutralizing the juice with lime and, after boiling and defecating, filtering it through bone-black.

250,201.—*Sulphonated compound of rosaniline.* HEINRICH CARO.

Trisulpho rosaniline produced by the action of crystallizable sulphuric acid on rosaniline.

250,247.—*Manufacture of rosaniline colors.* JOHN HOLLIDAY.

Another sulpho-conjugated compound of rosaniline.

250,326.—*Inoxidizable alloy.* PETER DE VILLIERS.

An alloy of tin, lead, and silver.

December 6, 1881.

250,333.—*Process of manufacturing crystallized anhydrate of grape-sugar from a watery solution of grape-sugar.* ARNO BEHR.

From concentrated solutions of high purity grape-sugar crystallizes in the anhydrous form, and not, as was generally believed, as a hydrate. If this crystallization is properly conducted and the liquid part removed by means of a centrifugal machine, crystallized anhydrous grape-sugar in the form of blocks resembling hard cane-sugar in appearance can be produced.

250,334.—*Method of refining grape-sugar.* ARNO BEHR.

Even in a concentrated solution of ordinary grape-sugar of moderate purity a crystallization of anhydrous grape-sugar can be induced if a very small quantity of crystallized anhydrous grape-sugar is stirred into the solution. On this observation is based a process for making from the product of the conversion of starch a grape-sugar of great purity, by crystallizing it and removing the impure liquid by means of a centrifugal machine.

250,416.—*Manufacture of sulphuric acid.* FREDERICK BENKER and HENRI LASNE.

"Mixing sulphurous acid gas with the gases which enter the Gay-Lussac tower."

250,418.—*Apparatus for filtering liquids.* FRANÇOIS A. BONNEFIN.

250,524.—*Process of, and machinery for, refining paraffine and other waxy matter.* DANIEL T. GRAY.

250,605.—*Manufacture of white lead.* WILLIAM THOMPSON.

Acetic acid vapor and air, and afterwards carbonic acid and air, are blown over sheet lead contained in a closed chamber.

250,824.—*Mode of making sugar.* WILLIAM LITTLEJOHN.

The defecation of the juice with lime and the bleaching with bisulphite of lime, shall be conducted in the following new and and peculiar manner, viz.: Successive additions of these chemicals shall be made, and after each addition it shall be ascertained with a small sample, "by ocular test," if a further addition produces an improvement.

December 20, 1881.

251,145.—*Explosive compound.* GUSTAV VON PLANITZ.

The product of a treatment of rosin with nitric acid.

251,162—251,164.—*Dye-stuff or coloring matter.* HEINRICH BAUM.

The first is the product of the reaction of the disulpho betanaphtholic sodium salt, soluble in alcohol, on diazobenzol; the last, of a mixture of two disulpho-betanaphtholic acids upon diazonaphthalene; the middle number only mentions a deep-red scarlet dye-stuff.

251,187.—*Zinc pigment, and process of making the same.* JOHN CAWLEY.

Precipitated sulphide of zinc and sulphate of barium are intimately mixed with caustic magnesia, calcined and ground.

251,279.—*Manufacture of paint for ships' bottoms, etc.* SAMUEL R. PERCY and HENRY A. MOTT, JR.

A paint containing picric acid or its salts.

December 27, 1881.

251,391.—*Manufacture of friction matches.* LOUIS WAGNER.

Gives the following proportions of a composition for topping matches: Hyposulphite of lead 34, peroxide of lead 5, chlorate of pot-

ash 16, gray sulphuret of antimony 6, pulverized charcoal 5, pulverized glass 10, saltpetre 4, sulphur 1, dextrine 1½, Cologne glue 1½, water 30 parts

251,473 and 251,474.—*Insulating composition or compound for coating electric or other wires and conductors.* FREDERICK W. SCHROEDER.

Glue, mastic, dextrine, chrome-alum, chloride of iron, and glycerine, with or without asbestos and albumen.

251,499.—*Manufacture of artificial indigo.* ADOLPH BAEYER.

The claim is for a new derivative of orthonitrophenylpropiolic acid called orthonitro-acetenylbenzene, from which indigo can be obtained.

251,500.—*Manufacture of artificial indigo.* ADOLPH BAEYER.

Another substance from which indigo can be obtained is di-isatogen, made from orthodinitro-acetenylphenyl with fuming sulphuric acid.

251,501.—*Manufacture of soluble derivatives of indigo-blue.* ADOLPH BAEYER.

Indigo-white sulphuric acid is produced by heating a mixture of indigo, ferrous sulphate, caustic potash, and an alkaline pyrosulphate.

251,671.—*Preparation of new material for the manufacture of artificial indigo.* ADOLPH BAEYER.

This material is orthodinitrodiacetenylphenyl, prepared from orthonitro-acetenylbenzene by a process which cannot be here described.

Foreign Patents

Condensed from R. BIEDERMANN'S Report to the German Chemical Society,

by OTTO H. KRAUSE.

J. W. KLINGHAMMER, Braunschweig: *Preparation of saccharate of lime from "Melassekalk"* by means of paraffine oil and other unsaponifiable oils of high boiling points.* (Germ. P., No. 11365, February 28, 1880.)—The syrup lime is treated successively with water of 80°–90° C. and paraffine oil of 100°–120°; the latter displaces the lye formed by the water in from 2 to 3 hours. The oil dissolves organic bases contained in the syrup lime. Then water of 80°–90° C. in its turn displaces the oil. Finally, the oily syrup lime is mixed with one-sixth of its bulk of water and heated by steam, whereby it melts, the oil forming a layer on the surface of the liquid. After syphoning it off and treating with acid, to obtain the organic bases, it can be used over again. Instead of the water, very dilute alcohol may be employed.

O. H. KRAUSE, Jersey City: *Improvements in apparatus for separating liquids from solid matters by means of centrifugal force.* (Germ. P., No. 11778, January 24, 1880.)—Consists of suitably shaped vessels of metal, glass, porcelain, etc., which

* *Melassekalk.*—Syrup lime is an impure saccharate of lime and is made by mixing the low grade syrups of beet-sugar factories and refineries with sufficient powder of slaked or unslaked lime to form a dry, porous mass.—O. H. K.

can be tightly closed and placed into the revolving basket of a centrifugal machine. Each vessel is divided into two compartments by means of a perforated vertical diaphragm and an inclined wall ; the latter does not quite extend to the top. The chamber next to the center of the basket is filled with the mixture to be operated upon. The outer one receives and retains the liquid which is driven into it by centrifugal action, the inclined wall preventing its return to the dried substance. See also this JOURNAL, 1, 506.

I. BONNY, Stulberg : *Gas-meter for chemical analyses.* (Germ. P., No. 12360, June 1, 1880.)—This apparatus, which is intended for aspirating and measuring large quantities of gas, consists of a measuring vessel containing a syphon, and is suspended by means of a spiral spring over a vessel of water having a constant level, under the surface of which the longer leg of the syphon passes. The measuring vessel is so connected with the service pipes as to carry on its functions automatically.

G. BORSCHE and I. BRUENJES, Leopoldshall : *Improvements in the method of working kainite.* (Germ. P., No. 12875, April 17, 1880.)—Relates to improvements upon Germ. P., No. 10701. See this JOURNAL, 2, 406.

HUGO MÜLLER, Kohlscheid : *Manufacture of aluminic hydrate and alkalies from native aluminic silicates.* (Germ. P., No. 12947, April 13, 1880.)—Aluminic silicates are intimately mixed with limestone, magnesite, or dolomite, and then with alkaline hydrates, carbonates, etc., and heated to bright redness. From the alkaline aluminate extracted from the mass, aluminic hydrate and alkaline carbonates are obtained in known manner.

BADISCHE ANILIN UND SODAFABRIK, Ludwigshaven : *Production of coloring matters by the action of diazo-anisols upon naphthols and naphtholsulphonic acids.* (Germ. P., No. 12451, Jan. 3, 1879.)—The amido derivatives of phenolic ethers are converted into diazo compounds, and then combined as such, or in the form of sulphonic acids, with amines or phenols to produce azo-dyes.

K. OEHLER, Offenbach : *Method of obtaining coloring matters by means of Lauth's reaction.* (Germ. P., No. 12932, July 14, 1880.)—Two reactions for obtaining amido-ethylaniline are described. The latter compound is treated, after the method given by Lauth, with hydrogen sulphide and oxidizing agents (ferric chloride), when it behaves like phenylenediamine, and yields a blue coloring matter.

C. M. WARREN, Paris : *Method of obtaining anthracene from coal-tar.* (Germ. P., No. 12933, July 16, 1880.)—Residues from the distillation of coal-tar are mixed with petroleum residues and again distilled. The method for separating the anthracene from the paraffines obtained at the same time is described.

A. DOMEIER and C. J. MARZELL, London : *Method of preparing artificial alizarine.* (Germ. P., No. 12938, Aug. 11, 1880.)—Relates to the treatment of the solution of the alizarine-melt in hot water with sulphurous acid, and to its recovery as well as that of the alkalies from the filtrate by means of causticizing with lime. The sulphuric acid required for decomposing the resulting calcium sulphate is obtained as a by-product in the preparation of anthraquinone.

N. G. SOERENSEN, Stockholm: *Black dye for leather.* (Germ. P., No. 13185, Oct. 13, 1880.)—A 1 per cent. solution of ammonium vanadate.

P. RICHTER and W. TRIEBEL, Berlin: *Apparatus for carburetting air.* (Germ. P., No. 12150, June 22, 1880.)—An apparatus for impregnating air with gasolene vapor, combined with an automatic regulator, by means of which a uniform carburation of the air is attained.

F. LITTMANN, Halle: *Ice generator and cooling apparatus.* (Germ. P., No. 11970, Feb. 7, 1880.)—The drum containing the cooling medium revolves upon its axis within the vessel containing the water to be frozen, and touches the surface of the latter. When an ice crust of sufficient thickness has formed, the drum is turned half round, and the ice thawed off by passing a warm current through the drum.

I. TOWNSEND, Stassfurt: *Improvements in the method of preparing chlorine.* (Germ. P., No. 12885, June 22, 1880.)—Heated air is passed through 40°–50° Bé solution of magnesium chloride, to which 10 per cent. of manganic oxide have been added.

ACTIENGESELLSCHAFT CROIX, Croix: *Improvements in the method of obtaining alkaline carbonates by means of trimethylamine.* (Germ. P., No. 13397, July 10, 1880, 2d addition to Germ. P., No. 5786. See this JOURNAL, 1, 298.)—Sodium sulphate is employed instead of the chloride. Its conversion into bicarbonate results when the apparatus is charged with 1 eq. of sodium sulphate and 1½ to 2 eq. of trimethylamine, and carbonic acid is passed in to saturation. By adding milk of lime to the trimethylamine sulphate, and distilling, the base is recovered.

W. J. WILLIAMS, Chester: *Manufacture of phosphates.* (Eng. P., No. 993, March 8, 1880.)—Native phosphates of iron, alumina, or the alkaline earths, are pulverized, intimately mixed with sodium chloride, and then with finely powdered coke, coal, or other reducing agent. The mixture is heated in a retort, and air and superheated steam passed over the mass which is kept stirred. Hydrochloric acid is evolved and sodium phosphate and aluminate formed.

T. TWYNAM, London: *Manufacture of magnesia.* (Eng. P., No. 1019, March 9, 1880.)—Pulverized dolomite is digested and boiled with solution of calcium chloride. From the filtrate separated from the magnesia calciumoxychloride crystallizes upon cooling. The latter is decomposed by cold water into calcium chloride and calcium hydrate. See Closson's patent, this JOURNAL, 2, 461.

A. CHAPMAN, Liverpool: *Apparatus for recovering soda from waste waters.* (Eng. P., No. 1078, March 12, 1880.)—Intended for recovering the soda from the very dilute solution in which esparto grass is boiled in paper mills. It consists of a steam boiler, into which the water is fed to be concentrated, a battery of vacuum pans, calcining furnace, etc., and an arrangement for utilizing the waste heat from the latter.

RAOUL BRULLÉ and A. LECLERC, Paris: *Obtain ammonia and ammoniacal salts from urine* (Eng. P., No. 1086, March 13, 1880), by adding milk of lime to the liquid and passing it in thin layers over heated surfaces in a distilling apparatus.

H. WIGGIN & Co., Birmingham: *Treatment of nickel and cobalt.* (Eng. P., No. 1058, March 11, 1880.)—From 2 to 5 per cent. of pure manganese or ferro-manganese are added to the molten metals to increase their ductility and malleability.

J. E. REYNOLDS, Dublin: *Method of coating metals with lead sulphide or lead luster.* (Eng. P., No. 1112, March 15, 1880.)—The objects to be coated may be of metal, glass, leather, paper, and the like; they are immersed in an alkaline solution of lead nitrate or tartrate, to which a slowly-decomposing sulphur compound has been added. As such the inventor employs sulphurea. The deposition takes place at 70° C.

W. MAJERT, Elberfeld: *Method of preparing blue coloring matters.* (Germ. P., No. 13281, April 13, 1880.)—A solution of 1 molecule of hydrochloride of nitrosodimethylaniline in 20 times its weight of hydrochloric acid, is mixed with the solution of 1 molecule of sodium thiosulphate dissolved in 10 parts of water. It is slowly heated. Upon cooling, an oxidizing agent is added when the coloring matter forms.

L. BECKERS, Spandau: *Method of dissolving caoutchouc in hydrocarbons of high boiling points.* (Germ. P., No. 13307, June 27, 1880.)

E. MOURLOT, FILS, Paris: *Substitute for gutta-percha.* (Germ. P., No. 13332, August 4, 1880.)—A decoction of birch-bark, evaporated to a thick paste, soon becomes hard in the air and behaves like caoutchouc.

T. H. GRAY, London: *Improvements in the treatment of oils for the manufacture of varnish.* (Germ. P., No. 12825, Jan. 10, 1880.)—Heated air is passed through linseed oil for several hours at a temperature of 120° C., and an equal length of time afterwards at 205° C. When acid vapors cease to be evolved, the oil suddenly becomes thick and forms a light gelatinous mass.

T. L. ALEMAND, Paris: *Substitute for leather.* (Eng. P., No. 1077, March 12, 1880.)

S. CLIFT, Conway, Wales: *Manufacture of coal-tar products.* (Eng. P., No. 967, March 5, 1880.)—Relates to the recovery of the alkali employed in purifying the oils.

A. GAWALOWSKI, Trabitsch, and F. TEICHMANN, Wagstadt: *Method of refining cane-juice, muscovadoes, and syrups.* (Eng. P., No. 861, Feb. 27, 1880.)—The inventors claim that by adding from 0.2 to 0.5 per cent. of aluminium phosphate to the heated liquor, filtration over bone-black is rendered unnecessary. The aluminium phosphate is prepared by dissolving aluminium hydrate in phosphoric acid, or from a mixture of bone-black dust, sulphuric acid, and aluminium sulphate. They also claim the finely divided carbon resulting from the manufacture of potassium ferrocyanide and from the calcination of nitrogenous organic matters.

M. HONIGMANN, Grevenberg: *Apparatus for distillation and absorption.* (Germ. P., No. 12889, July 18, 1880.)—An inclined cylinder, containing a large number of perforated diaphragms through which the gases and vapors pass in an opposite direction to the condensing liquid.

WEGELIN and HUEBNER, Halle: *Vacuum apparatus, with a separate vessel for the evaporating liquid.* (Germ. P., No. 12297, March 12, 1880.)

RHEINISCHE STAHLWERKE, Ruhrort, and HEVERDER BERGWERKS UND HUETTENVEREIN, Hoerde: *Method of dephosphorizing iron in the Bessemer process.* (Germ. P., No. 12700, April 10, 1880.)—Lime or dolomite, or a mixture of 8 parts lime and 1 part ferric oxide, is put into the converter before the metal is run in. The weight of this flux is about equal to double the amount of phosphorus and silicium contained in the charge. The rest of the specification relates to the manner of working the converter.

T. FLEITMANN, Iserlohn: *Method of welding iron, steel, copper and alloys of the latter, with nickel, cobalt and their alloys.* (Germ. P., No. 13304, June 8, 1880.)—Complete exclusion of air from the surfaces to be welded is necessary. To attain this the metals are enclosed in thin sheet iron, which is subsequently removed, or the metals are heated in air-tight vessels, or the air in the furnace is displaced by carburetted hydrogen or carbonic oxide.

I. GARNIER, Paris: *Manufacture of nickel alloys.* (Eng. P., No. 3009, July 21, 1880.)—Pure nickel, after melting, contains occluded oxygen, which renders it brittle. By adding phosphorus or phosphide of nickel to the metal the deleterious action of oxygen is prevented.

P. DE VILLIERS, St. Leonard: *Non-oxidizable alloys.* (Eng. P., No. 3394, Aug. 20, 1880.)—To be used chiefly for coating other metals, and is composed of 80 parts tin, 18 parts lead, and 2 parts silver.

B. BOLLINGER, Milan: *Infusible materials for lining furnaces, converters, etc.* (Eng. P., No. 3393, Aug. 20, 1880.)—Asbestos or serpentine, or mixtures of them, are mixed to a plastic mass with silicate of soda.

K. and T. MOELLER, Kupferhammer, near Brackwede: *Apparatus and methods for purifying feed water for steam boilers.* (Germ. P., No. 12496, Feb. 12, 1880; first addition to Germ. P., No. 7343; see this JOURNAL, 1, 503.)—Reference must be had to the original specification, in which the plant is minutely described and illustrated by drawings.

C. OTTO, Dahlhausen: *Arrangement for heating the gases from coking furnaces after tar and ammonia have been separated from them.* (Germ. P., No. 13156, September 14, 1880.)

A. PONGOWSKY, Sorgues sur l'Ouzève: *Apparatus and method for recovering the light hydrocarbons from petroleum, which are retained by the substances from which oil has been extracted.* (Germ. P., No. 12347, Feb. 29, 1880.)—Warmed air is passed through the substances. The air, charged with hydrocarbons, passing out of the apparatus is led to condensers.

G. W. DAVEY, Barking: *Distillation of coal-tar.* (Eng. P., No. 2666, June 29, 1880.)—Heated air is injected into the still.

I. P. STRENG, Fuerth: *Preparation of odorless brewers' pitch.* (Germ. P., No. 12811, May 30, 1880.)

E. N. HORSFORD, Cambridge : *Pulverulent preparations of phosphoric acid for the manufacture of baking powder.* (Eng. P., No. 2875, June 12, 1880.)—A concentrated solution of phosphoric acid is mixed with starch, dried and pulverized. By mixing this with a dry alkaline carbonate a baking powder is formed.

F. R. MALLET, Calcutta : *Paper filters.* (Eng. P., No. 2961, July 17, 1880.)—Instead of folding the filters from sheets, they are manufactured into a single conical piece by coating the inner surface of a porous cone with the paper pulp, and applying suction.

R. S. NEWALL and F. S. NEWALL, Newcastle: *Apparatus for effecting chemical decompositions.* (Eng. P., No. 2417, June 15, 1880.)—This invention relates chiefly to the decomposition of salt in the manufacture of soda. The sulphate pans are of the common form, but made of phosphor-bronze, and are jacketed so that steam or heated air can be applied to them. The mixture of acid and salt is kept in motion by means of a peculiar stirring apparatus. They are also supplied with arrangements for working them continuously.

I. P. RICKMAN and J. B. THOMPSON, London : *Manufacture of ammonia.* (Eng. P., No. 896, Mar. 1, 1880.)—The ammonia is generated by the slow combustion of coal in air and steam. Pyrites can be mixed with the coal when ammonium sulphate is to be made. The products of combustion are drawn, by means of an exhauster and bent tubes, through the absorbing liquid contained in a series of cells.

W. C. YOUNG, Poplar, Middlesex : *Manufacture of ammonium sulphate.* (Eng. P., No. 1310, Mar. 30, 1880.) *Manufacture of ammonium sulphate.* (Eng. P., No. 1310, Mar. 30, 1880.)—The products of the distillation of gas liquor are passed through a furnace together with a current of air, whereby the ammonium sulphide is converted into sulphite, and partly, also, into sulphate. They are then passed into condensers. To convert all the ammonium sulphite contained in the solution into sulphate, heated air is passed through the liquid.

T. G. YOUNG, Kelly : *Preparation of ammonia.* (Eng. P., No. 1640, April 26, 1880.)—Electric discharges are passed through a vessel containing 3 volumes of hydrogen and 1 volume of nitrogen.

W. A. HILLS, Saltney : *Preparation of dicalcium and tricalcium phosphate.* (Eng. P., No. 1512, April 13, 1880).—Proposes to decompose sodium phosphate by means of calcium thiosulphite obtained from alkali waste.

C. C. WALKER, Lilleshall, and W. T. WALKER, Highgate: *Method and apparatus for purifying illuminating gas.* (Germ. P., No. 2059, April 2, 1880.)—A cylinder, containing a number of diaphragms of gradually diminishing size of mesh, is placed between the condenser and scrubber for the purpose of retaining particles of tar.

PAUL AUBE, Paris: *Apparatus for the simultaneous production of steel and illuminating gas.* (Germ. P., No. 12837, April 15, 1880.)—A retort is charged with alternate layers of charcoal or coke and iron. A current of steam superheated in the same furnace is passed through this mass. At the same time, fatty matters are made to flow along the bottom of the retort which is heated to redness.

CHEMICAL WORKS "EISENBUETTEL," Braunschweig: *Preserving salt.* (Germ. P., No. 13545, May 28, 1880.)—Nitre and common salt are added to a fused mixture of 4 equivalents of boracic acid and 1 equivalent of sodium phosphate.

CH. LOWE and JOHN GILL, Manchester: *Coal tar manufactures.* (Eng. P., No. 1456, April 9, 1880.)—Phenols are obtained from the tar oils by decomposing the alkaline lyes with which they have been treated by means of sulphurous acid.

R. PUNSHON, Brighton: *Explosive compound.* (Eng. P., No. 2242, June 1, 1880.)—Nitric acid is mixed with pulverized asbestos and picric acid. The doughy mass is put into paper capsules and coated with a cement of powdered glass and silicate of soda.

C. A. BURGHARDT, Manchester: *Recovery of valuable products from fatty matters.* (Eng. P., No. 3030, July 23, 1880.)—Relates to the treatment of fatty matters containing alizarine, from dye works. The mass is distilled at 220° C. upon a sand or glycerine bath, and the fats or stearine passing over collected. The residue is extracted with methylated spirits.

S. SPENCE, Manchester: *Purification of waste waters.* (Eng. P., No. 2227, June 1, 1880.)—After the sewerage has been partially clarified it is mixed with a solution of aluminic or ferro-aluminic chloride or sulphate. As soon as the flocculent precipitate has settled the clear and odorless water can be drawn off. The alumina and ferric-oxide may be recovered by treating the precipitate with sulphuric acid in a separate vessel.

P. GONDOLO, Paris: *Extraction of tannin.* (Germ. P., No. 12513 and No. 12876, of July 2, and August 23, 1880, respectively. Additions to Germ. P., No. 7864; see this JOURNAL, **2**, 103.)—By treating the substances containing tannin with solutions of alkaline sulphites or bisulphites the deleterious lime salts are removed. The extract which contains sodium tannate is mixed with acid, clarified and evaporated. In Germ. P., No. 12513, the apparatus employed by the inventor is described. It is arranged and manipulated like a diffusion battery.

I. B. MACKAY, London: *Manufacture of a soluble cerium compound for medicinal purposes.* (Eng. P., No. 1275, March 25, 1880.)—A feebly alkaline solution of ammonium—cerium nitrate.

E. SOLVAY, Brussels: *Decomposition of calcium chloride for the preparation of hydrochloric acid and chlorine.* (Eng. P., No. 838, Feb. 25, 1880.)—A mixture of calcium chloride and clay is heated in a kind of cupola furnace and decomposed by means of steam or air, as the case may be. The calcium silico-aluminate resulting from this process yields a good cement when mixed with a small amount of lime, and calcined. For this purpose it is necessary that the decomposition of the calcium chloride be effected at as low a temperature as possible. (Eng. P., No. 840, Feb. 25, 1880.)

E. SOLVAY, Brussels: *Manufacture of chloride of lime.* (Eng. P., No. 837, Feb. 25, 1880.)—Slaked lime in the form of small pellets is placed in a cylinder into which chlorine enters from below. The latter is completely absorbed, and the chloride of lime obtained in the form of pieces or balls.

E. SOLVAY, Brussels: *Manufacture of hydrochloric acid.* (Eng. P., No. 837, Feb. 25, 1880.)—This invention is based upon the fact that a concentrated aqueous solution of calcium chloride retains water at a temperature at which hydrochloric acid gas is not absorbed. If, therefore, hydrochloric acid gas mixed with air, etc., etc., is passed through a concentrated solution of calcium chloride, the air escapes and hydrochloric acid and aqueous vapor are retained. By subsequently heating the solution the whole of the hydrochloric acid is evolved in the dry state. Fresh calcium chloride is added to the solution from time to time to keep up its strength.

VICTOR ALDER, Vienna: *Improvements in the generation of cyanides of the alkalies and alkaline earths, with the aid of nitrogen in closed vessels.* (Germ. P., No. 12351, March 11, 1880.)—The metals of the alkalies or alkaline earths are converted into cyanides under the following conditions: 1. If their oxides, hydrates or carbonates be heated to redness with coal in a non-oxidizing atmosphere of nitrogen; an addition of finely divided iron is said to act advantageously as a conveyer of the carbon. 2. If sulphates or sulphides of the alkalies be heated with calcium carbonate and coal in nitrogen. 3. If alkaline sulphates or sulphides and coal are heated to redness in nitrogen with a metal capable of combining with the sulphur. 4. If the sulphides of the alkaline earths be heated with hydrocarbons and the resulting oxides or carbonates treated according to 1. The heating is performed in retorts which can be tightly closed and are fitted with pipes for passing in nitrogen. The latter is obtained by deoxidizing air.

SOCIÉTÉ ANONYME DES PRODUITS CHIMIQUES DU SUD-OUEST, Paris: *Improvements in apparatus for distilling ammoniacal liquids.* (Germ. P., No. 13429, Aug. 3, 1880.)—The distillation is carried on in a rarified atmosphere at 80–90° C., at which temperature hardly any water passes over. The details of the apparatus cannot be properly described without the illustrations.

J. G. C. DEHAYNIN, Paris: *Improvements in the generation of water gas.* (Germ. P., No. 12264, Jan. 7, 1880.)—Steam is decomposed by coke in vertical retorts.

T. RICHTERS, Breslau: *Manufacture of ferro-cyanide, ammonia, tar and gas, from nitrogenous organic matters.* (Germ. P., No. 13594, Sept. 18, 1880.)—Nitrogenous waste of all kinds is saturated with potash solution, and then desiccated in a dryer into which carbonic acid can be passed. The dried matters are heated in a retort without melting them. Ammonia, gas and tar are collected, and cyanides, etc., extracted from the residue in known manner.

K. DRECHSLER, Dresden: *Pulverulent lubricant for shafting, etc.* (Germ. P., No. 13683, Aug. 12, 1880.)—See this JOURNAL, **2**, 358.

S. RÖSSLER, Troppau: *Production of tasteless and colorless alcohols, with simultaneous purification and regeneration of the matters used in the process.* (Germ. P., No. 13607, Aug. 15, 1880.)—Alcohol is rendered colorless and odorless and free from fusil oil, by mixing it with hydrocarbons or with fats of animal or vegetable origin, and distilling it. The fats, charged with fusil oil, are regenerated by heating them for some time, when the impurities separate in a layer. Methods for further purifying the fatty matters and fusil oil are described,

F. SCHMIDT and HAENSCH, Berlin : *Wedge-compensation for polariscopes.* (Germ. P., No. 11226, March 17, 1880.)—The quartz plate which compensates the rotation of the pair of quartz wedges at the zero point in Soleil's saccharometer is replaced by a second pair of quartz wedges having a separate scale. For every division upon one scale the zero position can therefore be re-established by means of the other pair of quartz wedges.

G. T. GLOVER, Belfast : *Manufacture of ammonia.* (Eng. P., No. 1890, May 8, 1880.)—Coal, bituminous shale, etc., are heated to redness in a furnace. A mixture of steam, furnace gases rich in nitrogen, and hydrochloric acid gas is passed over it. The products of the reaction are cooled and condensed to obtain ammonium chloride, etc.

G. N. TUCKER, London : *Improvements in the method of preparing ammonia and its salts, and apparatus for the same.* (Germ. P., No. 13392, April 25, 1880.)—Ammonia is prepared by means of nitride of boron and steam. Charcoal, coke, etc., are soaked with a warm solution of 10–20 parts boracic acid in 100 parts water, and an equivalent amount of alkali, or with a solution of borax and alkali. The coal so treated is mixed with carbonates of the alkaline earths, or with the oxides of manganese, antimony, iron, titaniferous iron, or with silicic acid, or with the boron compounds of these metals. The material so prepared is heated to bright redness in retorts. Furnace gases deprived of carbonic acid are then passed in. After the nitrogen has combined with the reduced boron, steam is admitted, which, being reduced by the coal and metals present, furnishes the hydrogen necessary to form ammonia. The ash left in the retorts is extracted with water to recover alkaline borates for impregnating the coal. The gases evolved in the retorts pass through milk of lime where carbonic acid, sulphuretted hydrogen and tarry matters are retained.

C. HUMFREY, Chester : *Decomposition of certain potassium and sodium salts.* (Eng. P., No. 1921, May 11, 1880.)—Proposes to decompose sodium aluminate with sulphurous acid. Tri-sodium phosphate is also to be treated with sulphurous acid, whereby disodium-phosphate and sodium sulphite are formed.

J. F. N. MACAY, Charapoto, Ecuador : *Improvements in the extraction of silver, copper and lead from ores, by means of solution of cupric chloride and sodium chloride.* (Germ. P., No. 13616, March 16, 1880.)—A number of reactions for treating the different ores and methods for utilizing the by-products are described. They can only be indicated here. The ground concentrated ore is heated in a glazed vessel with a solution of cupric chloride and chloride of sodium, until it forms a paste. This mass is again ground in a stone mill, steam being blown in. It then goes into the extracting vat.

1. Silver sulphide, if present, is thereby converted into chloride.

$$4\,CuCl_2 + NaCl + Ag_2S = Cu_2Cl + 2\,CuCl_2 + NaCl + 2\,AgCl + S.$$

After filtration the residue is washed with hot acidified water to remove copper salts. It is then treated with sodium thiosulphate to dissolve chloride of silver. The residue is now sulphur and gangue.

The solution of AgCl in sodium thiosulphate is boiled with sulphur to precipitate AgS and recover the thiosulphate. The AgS is boiled with $CuCl_2$ and

NaCl, and the resulting AgCl is dissolved in a hot concentrated solution of sodium chloride after the copper salts have been washed out. The sulphur is dried and used over again.

The AgCl in the NaCl solution is precipitated in the metallic state by means of iron. The ferric chloride is worked up into colcothar. (See Pat., No. 9565; this JOURNAL, **2**, 192.)

The filtrate from the extracting vat contains dissolved AgCl in consequence of the NaCl present. The silver is precipitated in the metallic state by copper. Upon the addition of acid to the solution cuprous chloride crystallizes out. The solution of cupric chloride and chloride of sodium is used in the treatment of fresh quantities of ore.

2. The ores free from silver, which are to be treated by this process, are essentially copper glance, copper pyrites, red oxide copper and atacamite.

The three first are treated as above described.

The cuprous sulphide being thereby converted into the chloride :—

$$2CuCl_2 + NaCl + Cu_2S = 2Cu_2Cl_2 + NaCl + S.$$

3. Atacamite is boiled with ferrous chloride.

$$6FeCl_2 + 2(CuCl,3CuO,4H_2O) + 3O = 3Fe_2O_3.H_2O + 8CuCl_2 + 5H_2O.$$

The ferric hydroxide is calcined to obtain colcothar.

4. When galena is to be treated, the before mentioned process being employed, we get

$$2CuCl_2 + NaCl + PbS = Cu_2Cl_2 + PbCl + S.$$

5. If the ore contains silver, copper and lead at the same time, it is ground as before and freed as much as possible from gangue. Hydrochloric or sulphuric acid must be added. If it should be found, after a preliminary experiment, that insoluble copper compounds remained in the residue after the treatment with cupric chloride and chloride of sodium. Modifications of these processes are described in case the material in the extracting vat contains antimony.

T. and R. HOLLIDAY, Huddersfield : *Dyeing cotton.* (Eng. P., No. 2757, July 6, 1880.)—Azo-dyes are applied directly upon the fiber by treating it with alpha or beta naphthol, and a diazo compound. The color is developed with alkali. The diazo compounds obtained from aniline and its homologues, naphthylamine, amido-azobenzine and its homologues, are mentioned as suitable for the purpose.

R. C. MENZIES and E. J. BEVAN, Musselburgh : *Paper for documents, bonds, etc.* (Eng. P., No. 2029, May 19, 1880.)—To render alterations in the writing or printing upon such paper by acids, alkalies, or chloride of lime, etc., easily visible, the following substances are added to the pulp, or applied with a brush to the finished paper (the quantities are given per 100 parts of finished paper) : Potassium iodide, 0.75%; potassium iodate, 0.75%; starch, 1%; manganic sulphate or carbonate, 2%; lead sulphate or carbonate, 2%.

D. MAC EACHRAN, Greenock. *Separation of iron from bone-black.* (Eng. P., No. 2779, July 7, 1880.)—The bone-black passes slowly over magnetized iron bars or through a grate made of such.

S. J. Cox, Yatton, Somerset: *Tanning hides.* (Eng. P., No. 2839, July 9, 1880.)—The prepared hides are first washed with dilute tanning liquor and then treated with the following liquid per sixty heavy hides:—1 cwt. ground bark, 1 cwt. ground valonia, 2 lbs. powdered zinc. The hides are placed in layers and the zinc powder thrown in between. After lying one or two weeks they are worked in the usual manner.

H. A. Clark, Boston: *Recovering caoutchouc and gutta-percha from waste.* (Eng. P., No. 229, Jan. 18, 1881.)—Boiling with water to separate the greater part of the sulphur, and mixing with 2 to 10% of palm oil. The whole is then heated and exposed to the action of turpentine or camphene vapors until it becomes plastic. Finally 2 to 10% of resinous substances are added.

W. Smith: *Solvent and detergent.* (Eng. P., No. 2025, May, 1880.)—Petroleum distillates of low boiling points are treated with chlorine gas until their disagreeable odor disappears. They are then mixed with milk of lime and soda lye and re-distilled.

H. Kropff, Nordhausen: *Improvements in ammonia ice machines.* (Germ. P., No. 13853, Nov. 24, 1880.)—The inventor proposes to employ two or more ammonia vessels instead of one, and to condense the gas from them in a common receptacle, and also to evaporate it in a common ice generator.

R. C. Anderson, Woodgreen, Middlesex: *Galvanic battery.* (Eng. P., No. 2564, June 23, 1880.)—The inventor proposes to prevent the deposition of copper upon the positive element of a Daniell's battery, by employing an intermediate cell containing a liquid of high conductivity and a metal, such as iron, capable of precipitating the copper.

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